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SELECTED WATER RESOURCES ABSTRACTS

VOLUME 9, NUMBER 7
APRIL 1, 1976

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SELECTED WATER RESOURCES ABSTRACTS

A Semimonthly Publication of the Water Resources Scientific Information Center, Office of Water Research and Technology, U.S. Department of the Interior

VOLUME 9, NUMBER 7
APRIL 1, 1976

W76-03001 -- W76-03299

The Secretary of the U.S. Department of the Interior has determined that the publication of this periodical is necessary in the transaction of the public business required by law of this Department. Use of funds for printing this periodical has been approved by the Director of the Office of Management and Budget through August 31, 1978.

As the Nation's principal conservation agency, the Department of the Interior has responsibility for most of our nationally owned public lands and natural resources. This includes fostering the wisest use of our land and water resources, protecting our fish and wildlife, preserving the environmental and cultural values of our national parks and historical places, and providing for the enjoyment of life through outdoor recreation. The Department assesses our energy and mineral resources and works to assure that their development is in the best interests of all our people. The Department also has a major responsibility for American Indian reservation communities and for people who live in Island Territories under U.S. administration.

FOREWORD

Selected Water Resources Abstracts, a semimonthly journal, includes abstracts of current and earlier pertinent monographs, journal articles, reports, and other publication formats. The contents of these documents cover the water-related aspects of the life, physical, and social sciences as well as related engineering and legal aspects of the characteristics, conservation, control, use, or management of water. Each abstract includes a full bibliographical citation and a set of descriptors or identifiers which are listed in the **Water Resources Thesaurus.** Each abstract entry is classified into 10 fields and 60 groups similar to the water resources research categories established by the Committee on Water Resources Research of the Federal Council for Science and Technology.

WRSIC IS NOT PRESENTLY IN A POSITION TO PROVIDE COPIES OF DOCUMENTS ABSTRACTED IN THIS JOURNAL. Sufficient bibliographic information is given to enable readers to order the desired documents from local libraries or other sources.

Selected Water Resources Abstracts is designed to serve the scientific and technical information needs of scientists, engineers, and managers as one of several planned services of the Water Resources Scientific Information Center (WRSIC). The Center was established by the Secretary of the Interior and has been designated by the Federal Council for Science and Technology to serve the water resources community by improving the communication of water-related research results. The Center is pursuing this objective by coordinating and supplementing the existing scientific and technical information activities associated with active research and investigation program in water resources.

To provide WRSIC with input, selected organizations with active water resources research programs are supported as "centers of competence" responsible for selecting, abstracting, and indexing from the current and earlier pertinent literature in specified subject areas.

Additional "centers of competence" have been established in cooperation with the Environmental Protection Agency. A directory of the Centers appears on the inside back cover.

Supplementary documentation is being secured from established discipline-oriented abstracting and indexing services. Currently an arrangement is in effect whereby the BioScience Information Service of Biological Abstracts supplies WRSIC with relevant references from the several subject areas of interest to our users. In addition to Biological Abstracts, references are acquired from Bioresearch Index which are without abstracts and therefore also appear abstractless in SWRA. Similar arrangements with other producers of abstracts are contemplated as planned augmentation of the information base.

The input from these Centers, and from the 51 Water Resources Research Institutes administered under the Water Resources Research Act of 1964, as well as input from the grantees and contractors of the Office of Water Research and Technology and other Federal water resource agencies with which the Center has agreements becomes the information base from which this journal is, and other information services will be, derived; these services include bibliographies, specialized indexes, literature searches, and state-of-the-art reviews.

Comments and suggestions concerning the contents and arrangements of this bulletin are welcome.

Water Resources Scientific Information Center
Office of Water Research and Technology
U.S. Department of the Interior
Washington, DC 20240

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01 NATURE OF WATER
Includes the following Groups: Properties; Aqueous Solutions and Suspensions

02 WATER CYCLE
Includes the following Groups: General; Precipitation; Snow, Ice, and Frost; Evaporation and Transpiration; Streamflow and Runoff; Groundwater; Water in Soils; Lakes; Water in Plants; Erosion and Sedimentation; Chemical Processes; Estuaries.

03 WATER SUPPLY AUGMENTATION AND CONSERVATION
Includes the following Groups: Saline Water Conversion; Water Yield Improvement; Use of Water of Impaired Quality; Conservation in Domestic and Municipal Use; Conservation in Industry; Conservation in Agriculture.

04 WATER QUANTITY MANAGEMENT AND CONTROL
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ABSTRACT SOURCES

SELECTED WATER RESOURCES ABSTRACTS

1. NATURE OF WATER

1B. Aqueous Solutions and Suspensions

A NEUTRON SCATTERING STUDY OF WATER AND IONIC SOLUTIONS - 1967, FIRST REPORT,
Union Carbide Corp., Tuxedo, N. Y. Sterling Forest Research Center.
G. J. Safford, A. W. Naumann, and P. C. Schaffer.
Available from the National Technical Information Service, Springfield, Va 22161, as PB-248 718, $6.00 in paper copy, $2.25 in microfiche. OSW Reasearch and Development Progress Report No 280 (OSW/RDPR/280), September 1967. 112 p, 41 fig, 5 tab, 71 ref, 3 append.

Descriptors: *Water properties, *Water structure, Molecular structure, Salts, Chemical properties, Neutron activation analysis, Ion exchange, Cations, Anions, Kinetics, Analytical techniques, Model studies.
Identifiers: Neutron scattering, Diffusive kinetics, Intermolecular frequencies.

The spectroscopic technique of neutron inelastic scattering has been used to examine the bonding and diffusive motions of H20 molecules in water and certain ionic solutions in an effort to relate them to models of the water structure and its modification by ions. Measurements of the vibrational spectra of water have been made from 1C to 95C. Information on the type of changes induced in the water structure by ions has been obtained from studies of the intermolecular frequencies in salt solutions. Measurements have been made to study in detail the modifications of the diffusive kinetics in water by selected ions. The data show that a reduction in temperature (i.e. to 1C) increases the residence time, decreases the diffusion constant, and intensifies any frequencies characteristic of a solid hydrate. Certain salts, even at higher concentrations, cause only a small modification of the water structure. Investigations of vibration spectra of ions in solutions also show that while distinct variations occur in the vibrational spectra of water molecules due to ions in solutions, the variation in the average vibrational period with temperature is not large. (See also W76-03261) (OWRT)
W76-03260

A NEUTRON SCATTERING STUDY OF WATER AND IONIC SOLUTIONS,
Union Carbide Corp., Tuxedo, N.Y.
G. J. Safford, and P. S. Leung.
Available from the National Technical Information Service, Springfield, Va 22161 as PB-203 120, $4.00 in paper copy, $2.25 in microfiche. Research and development progress report, Sep 69, 42 p, OSW-PR-485. DI 14-01-0001-1484.

Descriptors: Neutron activation analysis, Diffusion, Electrolytes, *Kinetics, *Water properties, *Anions, *Cations, Salts, *Molecular structures, *Water structures, Chemical analysis, Aqueous solutions, *Chlorides, Calcium chloride, Sodium chloride, Magnesium compounds, *Ion exchange, Fluorides, Halides, Analytical techniques.
Identifiers: *Neutron scattering, Diffusive kinetics, Intermolecular frequencies, Magnesium chloride.

Neutron inelastic scattering was used to study the dependences on concentration, cations, and anions of the intermolecular frequencies and the diffusive kinetics of water molecules in aqueous solutions. The intermolecular frequencies at lower concentrations of magnesium chloride, NaCl and CsCl were nearly identical with those of water with increasing concentration, new frequencies characteristic of primary hydration complexes appeared and intensified. The frequencies and diffusive parameters of solutions containing small or highly charged cations were primarily determined by the cations and only secondarily affected by monovalent anions. In contrast, a strong dependence on anions in solutions of larger, singecharged cations was observed at intermolecular frequencies and in diffusive kinetics. (See also W76-03260) (OWRT)
W76-03261

2. WATER CYCLE

2A. General

FLOW FORECASTING FOR THE BULL RUN WATERSHED,
Multinomah County Div. of Planning and Development, Portland, Oreg.
For primary bibliographic entry see Field 4D.
W76-03109

WATER QUALITY IN A TROPICAL RAIN FORESTED CATCHMENT,
University of New England, Armidale (Australia). Dept. of Geography.
For primary bibliographic entry see Field 5B.
W76-03132

HYBRID FORMULATION OF KINEMATIC WAVE MODELS OF WATERSHED RUNOFF,
New Mexico Institute of Mining and Technology, Socorro.
For primary bibliographic entry see Field 2E.
W76-03355

LAND-USE CHANGE AND THE WATER BALANCE--AN EXAMPLE OF AN EVAPOTRANSPIRATION SIMULATION MODEL,
Otago Univ., Dunedin (New Zealand). Dept. of Geography.
For primary bibliographic entry see Field 2D.
W76-03359

A NOTE OF CONVECTIVE PRECIPITATION IN NUMERICAL MODELS,
Indian Inst. of Science, Bangalore.
For primary bibliographic entry see Field 2B.
W76-03372

SIMULATION OF THE RAINFALL-RUNOFF PROCESS USING A HYSTERETIC INFILTRATION-REDISTRIBUTION MODEL,
New South Wales Univ., Kensington (Australia). School of Civil Engineering.
For primary bibliographic entry see Field 2G.
W76-03451

2B. Precipitation

HANDBOOK OF APPLIED WEATHER MODIFICATION, PART 1. COLD CLOUD MODIFICATION SUBSYSTEM, VOLUME 1. CUMULUS CLOUD TREATMENT.
Naval Weapons Center, China Lake, Calif. Research Dept.
For primary bibliographic entry see Field 3B.
W76-03101

METEOROLOGICAL AND HYDROLOGICAL DATA REQUIRED IN PLANNING THE DEVELOPMENT OF WATER RESOURCES (PLANNING AND DESIGN LEVEL),
World Meteorological Organization, Geneva (Switzerland).
For primary bibliographic entry see Field 4A.
W76-03103

AN EVALUATION OF WEATHER MODIFICATION ACTIVITIES IN THE TEXAS HIGH PLAINS,
Texas A and M Univ., College Station. Center for Applied Geosciences.
For primary bibliographic entry see Field 3B.
W76-03104

A NUMERICAL DETERMINATION OF THE EFFICIENCY WITH WHICH ELECTRICALLY CHARGED CLOUD DROPS AND SMALL RAINDROS COLLIDE WITH ELECTRICALLY CHARGED SPHERICAL PARTICLES OF VARIOUS DENSITIES,
California Univ., Los Angeles. Dept. of Meteorology.
S. N. Grover, and K. V. Beard.
Journal of the Atmospheric Sciences, Vol 32, No 11, p 2156-2165, November 1975. 7 fig, 2 tab, 19 ref, 2 append.

Descriptors: *Drops(Fluids), *Cloud physics, *Model studies, Mathematical models, Particle size, Particle shape, Raindrops, Clouds, Reynolds number, Electrical studies, Electrical conductance, Rainfall, Meteorology.
Identifiers: *Collision efficiency, Charged drops, Charged particles, Electrostatic forces.

Numerical computations were carried out to determine the efficiency with which electrically charged cloud drops and small raindrops of diameters ranging from 84 to 866 micrometers collide with electrically charged particles of densities between 1 and 4 g/cc and diameters between 0.4 and 20 micrometers. For this purpose, numerical flow fields about rigid spheres of Reynolds numbers 1, 10, 20, 100 and 200 were used to integrate the trajectory of the particle relative to the collector drop. Two approximate methods were used to represent the electrostatic force between the drop and the particle, and the resulting collision efficiencies showed that the representation of the drop and particle by two point charges is a sufficient approximation of the electrostatic fource for the majority of atmospheric charges , as long as the drop diameter is larger than 208 micrometers. For typical charges on drops and particles observed in the atmosphere, and for attractive electrostatic forces, the collision efficiency results for particles smaller than 2 micrometers in diameter showed a significant increase over the collision efficiencies for the case of no electric charges. (Sims-ISWS)
W76-03108

THE EFFECT OF ELECTRICAL CONDUCTIVITY ON THE GROWTH OF THE ELECTRIC FIELD IN A THUNDERSTORM,
Tel-Aviv Univ. (Israel). Dept. of Environmental Sciences.
Z. Levin, and W. D. Scott.
Tellus, Vol 27, No 5, p 497-506, 1975. 5 fig, 2 tab, 27 ref.

Descriptors: *Thunderstorms, *Electric fields, *Electrical conductance, *Cloud physics, Electrical properties, Clouds, Precipitation(Atmospheric), Rainfall, Atmosphere, Model studies, Mathematical models, Drops(Fluids), Raindrops, Meteorology.

The effect of the electrical conductivity on the electrical development of the cloud was investigated. By the use of a numerical model which couples the growth of the electric field and the precipitation development, it was demonstrated that as long as the conductivity varies between values which are smaller than the fair weather conductivity and values of up to 100 times the fair weather conductivity, the polarization charging mechanism is powerful enough to generate fields large enough to create lightning. (Sims-ISWS)

W76-03113

SEASONAL VARIABILITY OF RAINWATER REDISTRIBUTION BY FIELD SOILS,
Birkbeck Coll., London (England).
For primary bibliographic entry see Field 2G.
W76-03131

MONTHLY WINTER SNOWLINE VARIATION IN THE NORTHERN HEMISPHERE FROM SATELLITE RECORDS, 1966-75,
National Environmental Satellite Service, Washington, D.c.
For primary bibliographic entry see Field 2C.
W76-03180

STORM TIDE FREQUENCY ANALYSIS FOR THE COAST OF NORTH CAROLINA, NORTH OF CAPE LOOKOUT,
National Weather Service, Silver Spring, Md.
F. P. Ho, and R. J. Tracey.
Available from the National Technical Information Service, Springfield, Va 22161. NOAA Technical Memorandum NWS HYDRO-27, November 1975. 46 p, 17 fig, 6 tab, 29 ref.

Descriptors: *Hurricanes, *Storms, *Storm surge, Coasts, Floods, Climatology, Tropical cyclones, Storm structure, Tidal effects, Tidal waters, *North Carolina, Land use, Management.
Identifiers: *Storm tide frequency, *Storm tides, *Tide frequencies, *Cape Lookout(NC), Storm surge model, Tidal gages, Coastal floods, Hurricane tracks, Storm tracks.

Storm tide height frequency distribution are developed on the coast of North Carolina, north of Cape Lookout, for the National Flood Insurance Program. Storm tides are computed from a full set of climatologically representative hurricane using the National Weather Service numerical-dynamic storm surge model. Winter storm effects are estimated from tide gage records. Storm tide levels from all storms are shown in coastal profile between annual frequencies of 0.10 and .002. This report is intended for use in estimating acturial risk to buildings from coastal floods and in land use management. (NOAA)
W76-03181

MOISTURE SOURCE FOR THREE EXTREME LOCAL RAINFALLS IN THE SOUTHERN INTERMOUNTAIN REGION,
National Weather Service, Silver Spring, Md.
E. M. Hansen.
Available from the National Technical Information Service, Springfield, Va 22161. NOAA Technical Memorandum NWS HYDRO-26, November 1975. 57 p, 33 fig, 3 tab, 24 ref.

Descriptors: *Rainfall, *Rainfall disposition, *Rainfall intensity, *Local precipitation, *Water sources, *Moisture, Weather patterns, Storms, Precipitation(Atmospheric), Weather data, Tropical regions, Climalogy, Synoptic analysis, Southwest U.S.
Identifiers: *Moisture sources(Atmospheric), Local rainfall, Southern U.S. intermountain regions, Rainfall studies, Synoptic data, High moisture levels, Moisture levels, Tropical moisture, Summer precipitation, Weather maps, Storm studies.

Three cases of extreme local precipitation within the Intermountain summer season were studied to determine the source of moisture for these events. Synoptic data were used to analyze surface and upper level moisture changes in time and space. In each case the study showed that a tongue of high moisture at low levels approached the vicinity of or encompassed the storm area prior to onset of the rain. The tongue of moisture was very narrow in reaching toward the Elko and Morgan storms and could be traced, through continuity of changes in pattern with time, back to the Gulf of California. The moisture is believed to be conveyed through the natural channel provided by the Gulf and the paralleling ridges. The low-level moisture followed a path controlled to some extent by major mountain barriers. A general conclusion is that greater emphasis should be given to tropical Pacific moisture in evaluating extreme summer precipitation values for the Intermountain region. (NOAA)
W76-03182

ANNOTATED BIBLIOGRAPHY OF NOAA PUBLICATIONS OF HYDROMETEOROLOGICAL INTEREST,
National Oceanic and Atmospheric Administration, Washington, D.C.
J. F. Miller.
Available from the National Technical Information Service, Springfield, Va 22161. NOAA Technical Memorandum NWS HYDRO-22, May 1975, 50 p.

Descriptors: *Bibliographies, *Publications, *Meteorology, *Meteorological data, *Hydrology, Precipitation(Atmospheric), Climatic data, Climatology, Rainfall, Weather data, Evaporation, Storms, Clouds, Flood data.
Identifiers: *Annotated bibliography, Relative humidity, Precipitable water, Climatological observations, Weather observations.

This is a bibliography of NOAA publications that have some hydrometeorological interest. It is intended to provide the engineer or hydrologist with a summary of that information published by NOAA. This bibliography is not intended to be a comprehensive listing of everything that has been published by NOAA scientists in the field of hydrometeorology. The material listed in this publication lists relevant publications prepared by NOAA in the past 20 years. As may be recognized, a good many of these publications are out of print. Certainly a portion of the research results in some of these reports have been invalidated by later investigations. They are listed because they may provide the only source for some useful information or because they provide valuable background information on various topics.(NOAA)
W76-03183

STUDIES OF SELECTED PRECIPITATION CASES FROM METROMEX.
Illinois State Water Survey, Urbana.
Available from the National Technical Information Service, Springfield, Va 22161, as PB-248 669, $10.00 in paper copy, $2.25 in microfiche. Report of Investigation 81, 1975. 329 p, 251 fig, 23 tab, 66 ref. Changnon, S.A., and Semonin, R.G., Editors. NSF GI-38317, GI-38329, GI-39213; ERDA AEC 1199.

Descriptors: *Rainfall, *Cities, *Chemistry of precipitation, Storms, Thunderstorms, Rainfall disposition, Boundary layers, Cloud physics, Weather modification, Air pollution, Networks, Measurement, Radar, Precipitation(Atmospheric), Climatology, Meteorology, Missouri.
Identifiers: *St. Louis(Mo), *METROMEX.

In the analysis of METROMEX field data, 9 rain periods (case days) in 1972 and 1973 were chosen for in-depth investigations to better define the urban-related mechanisms that cause the summer rainfall in and east of St. Louis and Wood River to be greater than that in surrounding areas. The 9 cases were selected to represent a variety of summer precipitation conditions in the St. Louis area. These investigations identified several urban-related conditions that contributed to the observed precipitation alterations. Principal findings were that the urban areas: (1) initiated and thus increased the number of raincells; (2) intensified rain and severe weather from the urban-initiated cells by their subsequent merger with each other or a later system; (3) intensified rain and severe weather from existing cells passing over the urban areas by the effect of their heat, moisture, and/or aerosol plumes; (4) produced these effects only when rain-conducive synoptic conditions existed; and (5) operated with a 'domino' effect in which urban cells beget more urban cells on the same day and tend to reinforce developments in a multi-day sequence in the same locale. The case studies also revealed missing or inadequate measurements critical for METROMEX or other field projects and provided guidance for direction of the research. (Sims-ISWS)
W76-03353

SECULAR CHANGES IN SOUTH AFRICA RAINFALL: 1880 TO 1972,
University of the Witwatersrand, Johannesburg (South Africa).
P. D. Tyson, T. G. J. Dyer, and M. N. Mametse.
Quarterly Journal of the Royal Meteorological Society, Vol 101, No 430, p 817-833, October 1975. 13 fig, 2 tab, 47 ref.

Descriptors: *Climates, *Precipitation(Atmospheric), *Rainfall, Africa, Statistical methods, Fourier analysis, Mathematical studies, Numerical analysis, *Time series analysis, Cycles, Meteorological data, Seasonal, Droughts, Wet seasons, Variability.
Identifiers: *South Africa, Annual rainfall series, Trend analysis, Serial correlation, Spectral analysis, Serial analysis, Mathematical filtering, Oscillations.

Analysis of time series for 157 stations with records covering the period 1910-1972 and for fewer stations with records extending back to 1880 suggested that the commonly held view that South Africa, as a whole, is undergoing progressive desiccation must be questioned. Instead the data suggested the specific regional occurence of weak (but nonetheless readily discernible) oscillations of 16-20 and 10-12 years, the ubiquity of 3-4 year fluctuations, and the spatially distinctive occurrence of a quasi-biennial oscillation. (Jones-ISWS)
W76-03367

THE ASSIGNMENT OF RAINFALL STATIONS INTO HOMOGENEOUS GROUPS: AN APPLICATION OF PRINCIPAL COMPONENT ANALYSIS,
University of the Witwatersrand, Johannesburg (South Africa). Dept. of Applied Mathematics.
T. G. J. Dyer.
Quarterly Journal of the Royal Meteorological Society, Vol 101, No 430, p 1005-1013, October 1975. 7 fig, 2 tab, 12 ref.

Descriptors: *Rainfall, *Precipitation(Atmospheric), *Statistical methods, *Forecasting, Africa, Model studies, Stochastic processes.
Identifiers: *Eigenvectors, *South Africa, *Eigenvalues, Annual precipitation, *Principal component analysis, Stochastic models.

The calculation of eigenvectors has been used to describe annual precipitation totals over an area of large extent. Rotation of the eigenvectors brought about further clarification of the system of recording stations. By noting the eigenvector of most importance to each station, delimitation of an area was made possible. Reduction in records, a necessary prelude to future work on forecasting models, was obtained by discarding those stations most closely related to eigenvectors whose eigenvalue was less than 0.6. (Jones-ISWS)
W76-03368

A NOTE OF CONVECTIVE PRECIPITATION IN NUMERICAL MODELS,
Indian Inst. of Science, Bangalore.
M. S. Rao.
Indian Journal of Meteorology and Geophysics, Vol 25, No 1, p 47-50, January 1974. 1 fig, 1 tab, 4 ref.

Descriptors: *Numerical analysis, *Rainfall, *Convection, Radiosondes, Entrainment, Model studies.
Identifiers: *Numerical modeling, *Convective precipitation.

With the help of the observed radiosonde and convective rainfall data for two Indian stations, the methods Kuo, Arakawa, and the convective adjustment method of computing convective rainfall in numerical models were compared. It was found that the rainfall computed by all three methods is comparable to the observed rainfall. However, computed rainfall differes considerably from one method to another. (Jones-ISWS)
W76-03372

COMPARATIVE STUDY OF SHOWALTER'S STABILITY INDEX AND GEORGE'S INSTABILITY VALUE K FOR PREDICTING LOCAL THUNDERSTORM OVER CALCUTTA AIRPORT,
Meteorological Office, Calcutta (India).
G. Singh, and C. L. Agnihotri.
Indian Journal of Meteorology and Geophysics, Vol 25, No 1, p 51-54, January 1974. 2 fig, 2 tab, 8 ref.

Descriptors: *Forecasting, *Thunderstorms, Convection, Stability, Radiosondes, Meteorology.
Identifiers: *Calcutta(India), Instability, Convergence, Divergence, Indices.

Showalter's stability index and George's instability value K have been calculated for 1200 observations of pre-monsoon months of Calcutta Airport. The results show that George's instability value K gives a better indication for occurrence or non-occurrence of a thunderstorm than Showalter's stability index. It has also been found that if the value of George's instability index works out to be 28 or less in the morning or evening radiosonde observation (which happens on about 48% of the total occasions) non-occurrence of a thunderstorm over Calcutta Airport during the next 15 hours can be predicted with reasonable certainty. (Jones-ISWS)
W76-03373

PB-210 IN PRECIPITATION IN JAPAN AND ITS IMPLICATION FOR TRANSPORT OF CONTINENTAL AERSOLS ACROSS THE OCEAN,
Hokkaido Univ., Hakodate (Japan). Faculty of Fisheries; and Hokkaido Univ., Sapporo (Japan). Dept. of Chemistry.
For primary bibliographic entry see Field 5B.
W76-03385

THE PROBABILITY OF HAIL WITHIN A SPECIFIED AREA,
National Physical Research Lab., Pretoria (South Africa).
A. E. Carte.
Journal of the Atmospheric Sciences, Vol 32, No 4, p 866-868, April 1974. 3 fig, 3 ref.

Descriptors: *Hail, *Probability, Protection, Cloud seeding, Mathematical studies.
Identifiers: *Hailfalls, Hail protection, Hailstreaks, Hail suppression.

A method was given for deriving the probability that a circular hail area within a certain 'operational' area will fall on an inner area. Results were very similar to those calculated by Magaziner and Weickmann for straight-line hailstreaks. Families of curves were shown for both hail areas which fall partially within the protected area and those that fall wholly within the protected area. (Jones-ISWS)
W76-03386

2C. Snow, Ice, and Frost

WINTER SOIL WATER DYNAMICS,
Alaska Univ., College. Inst. of Water Resources.
For primary bibliographic entry see Field 2G.
W76-03002

SEASONAL CHARACTERISTICS OF WATER MASSES IN MUIR INLET, A FJORD WITH TIDEWATER GLACIERS,
Alaska Univ., College. Inst. of Marine Science.
For primary bibliographic entry see Field 2L.
W76-03112

EFFECTS OF LARGE THERMAL DISCHARGES ON ICE-COVERED RIVERS,
Iowa Univ., Iowa City. Inst. of Hydraulic Research.
For primary bibliographic entry see Field 5C.
W76-03139

STRUCTURE AND PROPERTIES OF ICE LENSES IN FROZEN GROUND,
Alaska Univ., College. Geophysical Inst.
T. E. Osterkamp.
Available from the National Technical Information Service, Springfield, Va 22161 as PB-248 708, $4.00 in paper copy, $2.25 in microfiche. Scientific Report UAG R-233, February 1975. 30 p, 12 fig, 14 ref. OWRT C-4049(9010)(1).

Descriptors: *Permafrost, *Frozen ground, *Ice, *Arctic, Frost, Ice, Crystals, On-site investigations, Cold regions.
Identifiers: *Ice lenses.

A diamond wire saw was modified for cutting thin sections of frozen soil and suitable operating conditions were determined experimentally. A lubricated wire, 0.34 mm in diameter, operated at cutting speeds less than 30 cm/sec and cutting forces less than 100 g produced smooth cut surfaces on thin sections 0.4-0.5 mm in thickness. The temperature and wire size were not critical operating parameters and the wire tensions recommended by the manufacturer were satisfactory. A technique for mounting, photographing and storing the thin sections was described. More than 50 thin sections were cut from several frozen ground cores. Ice lenses in a well-drained silt were few in number and formed as filaments or small platelets. Ice lenses in a sandy clayish loam were numerous and formed as thin platelets. The ice crystals in these ice lenses were elongated in the vertical direction with nearly vertical crystal boundaries extending from one side of the lenses to the other. The possible flux of water through the ice lenses in frozen soil near the melting point was estimated to be about 1 cm/day. (Sims-ISWS)
W76-03140

MONTHLY WINTER SNOWLINE VARIATION IN THE NORTHERN HEMISPHERE FROM SATELLITE RECORDS, 1966-75,
National Environmental Satellite Service, Washington, D.c.
D. R. Wiesnet, and M. Matson.
Available from National Technical Information Service, Springfield, Va 22161 NOAA Technical Memorandum NESS 74, November 1975. 21 p, 12 fig, 1 tab, 8 ref.

Descriptors: *Snow cover, *Snow, *Satellites(Artificial), Snow surveys, Snowfall, Weather, Ice, Meteorology, Weather forecasting, Albedo, Hydrology.
Identifiers: *Snowline variation, *Satellite records, *Satellite imagery, *Hemispheric snow cover, Global temperature, Weather satellites, Meteorological satellites, Northern Hemisphere, Weather maps.

The application of satellite imagery for detecting, measuring, and mapping mean monthly winter snow cover over the Northern Hemisphere is demonstrated. Maps and graphs are used to depict snow cover for North America, Eurasia, and the Northern Hemisphere for the months of December through March for the period 1966-75. Although snow cover over North America tended to be fairly uniform during the 9-year period, over Eurasia and the Northern Hemisphere a cyclical pattern is evident. This satellite record of the past 9 years is the most complete record of hemispheric snow cover available. NOAA satellites provide a reliable means of monitoring worldwide snow cover, which has important effects on global temperature and albedo, with attendant impact on hydrology, agriculture, and weather forecasting. (NOAA)
W76-03180

APPLICATION OF REMOTE-SENSING TECHNIQUES TO THE STUDY OF SEASONAL SNOW COVER,
Geological Survey, Tacoma, Wash.
M. F. Meier.
Journal of Glaciology, Vol 15, No 73, p 251-265, 1975. 9 fig, 34 ref.

Descriptors: *Remote sensing, *Snow cover, *Snow surveys, *Electromagnetic waves, *Radiation, Methodology, Analytical techniques, Aerial photography, Satellites(Artificial), Meteorological data, Evaluation.

This paper discusses the measurement of important snow properties using electromagnetic radiation. Snow areal extent can be measured using manual, optical, electronic, or digital techniques from data supplied by visible and near-visible light sensors carried on Earth resources and meteorological satellites, but these techniques cannot routinely detect snow under clouds or a forest canopy. Gamma-ray techniques used at stations or from low-flying aircraft permit measurement of water equivalent of snow (depth times density). Active or passive microwave systems may permit this to be done over larger areas, but the physics of this possible technique is not yet sufficiently understood. Wetness or temperature of a snow surfaces is measurable with thermal infrared radiometers; wetness throughout a snow pack may be measurable with microwave radiometers. Much research needs to be done on the electrical (including scattering) properties of snow before efficient, all-weather, remote-sensing systems can be designed. (Woodard-USGS)
W76-03389

GLACIER APPLICATIONS OF ERTS IMAGERY,
Geological Survey, Tacoma, Wash.
R. M. Krimmel, and M. F. Meier.
Journal of Glaciology, Vol 15, No 73, p 391-402, 1975. 11 fig, 4 ref.

Descriptors: *Glaciology, *Remote sensing, *Aerial photography, *Satellites(Artificial), Meteorological data, Snow cover, Glaciers, Movement, Photogrammetry, Infrared radiation.

The ERTS satellite scanners have continued to relay images to Earth from the launch on 23 July 1972 to the present (summer 1974). Images from four spectral bands with ground resolution of about 100 m, cover an area 185 km on a side. The resulting images have proved to be very useful for collecting certain basic data from glaciers. Long-term surface velocities are readily determined by comparison of recent ERTS images with maps that have been produced from earlier data. Images have been used to measure velocities on the Malaspina Glacier over a 10 year period, surge displacements on the Lowell, Tenas Tilke, and Tweeksmuir Glaciers and Lednik Medvezhiy, and velocity at the margin of the Hubbard Glacier. Many surging glaciers are readily identifiable in

the images. Coverage from the satellite will allow surging glaciers to be identified world-wide which may help glaciologists to understand their peculiar geographical distribution. Images of large glaciers taken under conditions of low sun angle and complete snow cover show previously undetected subtle slope changes which can be interpreted as dynamic flow features or reflections of subglacial topography. ERTS imagery is providing new glacier data for several reasons: very large areas are covered repetitively with sufficient consistency to show subtle tonal changes, conditions of maximum and minimum snow cover, subtle morphologic features at low sun angle, and changes in position of glaciers. (Woodard-USGS)
W76-03390

NEW WAYS TO MONITOR THE MASS AND AREAL EXTENT OF SNOW COVER,
Geological Survey, Tacoma, Wash.
M. F. Meier.
Reprint from Proceedings of Symposium on Approaches to Earth Survey Problems through Use of Space Techniques, held in Constance, Germany, May 23-25, 1973: Committee on Space Research (of the International Council of Scientific Unions) COSPAR, p 241-250, 1974. 3 fig, 37 ref.

Descriptors: *Remote sensing, *Snow cover, *Aerial photography, *Microwaves, Aircraft, Methodology, Analytical techniques, Water equivalent, Planning, Monitoring, Evaluation, Cloud cover.

ERTS-type satellites represent a great step forward in measuring snow cover, but systems employing only visible or infrared sensors are seriously limited by cloud cover and vegetation and provide no data from below the surface of the snow. Thus microwave or radio wavelength sensors are required. Active systems are now used from aircraft to measure the thickness and internal structure of polar ice sheets. Passive microwave emission techniques appear to offer the potential of continuous monitoring of snowcovered area, snow wetness, and possibly snow water equivalent. (Woodard-USGS)
W76-03391

2D. Evaporation and Transpiration

LAND-USE CHANGE AND THE WATER BALANCE--AN EXAMPLE OF AN EVAPOTRANSPIRATION SIMULATION MODEL,
Otago Univ., Dunedin (New Zealand). Dept. of Geography.
B. B. Fitzharris.
Journal of Hydrology (New Zealand), Vol 13, No 2, p 98-114, 1974. 7 fig, 15 ref.

Descriptors: *Land use, *Water balance, *Evapotranspiration, *Simulation analysis, Runoff, Albedo, Pastures, Model studies, Vegetation, Coniferous trees, Latent heat, Numerical analysis, Climatic data.
Identifiers: *Land-use change, *New Zealand, *Alexandra(New Zealand), Coniferous forest, Flux density, Bowen ration.

Land-use change in New Zealand may have altered runoff, because of changes in evapotranspiration. The effects of changing albedo, surface roughness, and supply of water on evapotranspiration were simulated with the Myrup numerical model of the energy balance. The model was applied to a hypothetical example in Central Otago, where a scrub/tussock area was converted to improved pasture. Investigation of the model over a wider range of conditions indicated that a change from low vegetation with an albedo of 0.35 to young coniferous forest increased the daily potential evapotranspiration by about 75 percent. Differences between land-use types tended to be reduced as soil water deficit increased. The behavior of the model on an annual basis was illustrated for climatological data for Alexandra. The simulated results needed to be confirmed by actual measurements of evapotranspiration, but use of the model did have several advantages. (Roberts-ISWS)
W76-03359

AN ESTIMATE OF TOTAL SURFACE AREA OF VEGETATION FOR PUKEITI CATCHMENT, NORTHLAND, NEW ZEALAND,
Ministry of Works and Development, Nelson (New Zealand).
For primary bibliographic entry see Field 4D.
W76-03360

EVAPORATION FROM LAKE ERIE,
National Oceanic and Atmospheric Administration, Boulder, Colo. Environment Research Labs.
J. A. Derecki.
Available from Superintendent of Documents, C55.13:ERL 342-GLERL 3 US Government Printing Office Washington, DC 20402. NOAA Technical Report ERL 342-GLERL 3, June 1975, 92 p.

Descriptors: *Evaporation, *Water levels, *Water loss, *Evaporimeters, Lake Erie, Condensation, Energy budget, Air-water interfaces, Meteorological data, Water vapor, Measurement, Great lakes, Lakes, Humidity, Hydrologic budget, Bodies of water.
Identifiers: *Lake evaporation, *Lake levels, *Lake Erie evaporation, Two mass transfer.

The monthly evaporation from Lake Erie was derived by the water budget, two mass transfer, energy budget, and two combined mass transfer-energy budget equations. The period of record varies with the availability of data, from 32 years for the water budget and mass transfer methods to 17 years for the other methods. Evaporation determined by a single method is not sufficiently reliable and requires verification of accuracy by different methods. Only the water budget method determines evaporation directly, as a residual from other measurements, and it was used as a control for other estimates of evaporation. The overall analysis of results indicates that reasonably accurate evaporation estimates during the year can be obtained by the water budget and the modified Lake Hefner mass transfer equations, and during the high evaporation season by the energy budget equation. The combined mass transfer-energy budge equations produced evaporation estimates which are considered to be of much lower accuracy. (NOAA)
W76-03415

2E. Streamflow and Runoff

METEOROLOGICAL AND HYDROLOGICAL DATA REQUIRED IN PLANNING THE DEVELOPMENT OF WATER RESOURCES (PLANNING AND DESIGN LEVEL),
World Meteorological Organization, Geneva (Switzerland).
For primary bibliographic entry see Field 4A.
W76-03103

FLOW FORECASTING FOR THE BULL RUN WATERSHED,
Multinomah County Div. of Planning and Development, Portland, Oreg.
For primary bibliographic entry see Field 4D.
W76-03109

EFFECT OF SEPARATION ANGLE ON VORTEX STREETS,
Durham Univ., (England). Dept. of Engineering Science.
For primary bibliographic entry see Field 8B.
W76-03116

HEAT ASSIMILATIVE CAPACITY OF THE SANGAMON RIVER,
Illinois State Water Survey, Urbana.
For primary bibliographic entry see Field 5B.
W76-03142

INTERVENTION ANALYSIS IN WATER RESOURCES,
Waterloo Univ., (Ontario). Dept. of Civil Engineering.
K. W. Hipel, W. C. Lennox, T. E. Unny, and A. I. McLeod.
Water Resources Research, Vol 11, No 6, p 855-861, December 1975. 3 fig, 1 tab, 25 equ, 10 ref.

Descriptors: *Water resources, *Stochastic processes, *Time series analysis, *Hydrology, River flow, Dams, Projects, Reservoirs, Estimating, Water quality, Annual, Control, Mathematical models, Systems analysis, Equations.
Identifiers: *Intervention analysis, Nile River(Africa), Aswan(Egypt), Noise component, Box-Jenkins transfer function models.

Intervention analysis is a stochastic transfer function modeling technique to investigate rigorously whether or not a natural or man-induced intervention causes a significant change in the mean level of a time series. Many types of man-made or natural interventions occur in natural hydrologic phenomena. In order to use an observed hydrologic time series as a reliable input to the system design and operation of a water resource project, it is necessary to be able to model the time series accurately. Intervention analysis is a viable technique to model correctly a hydrologic time series and account accurately for any external influences affecting that series. The mathematics of intervention analysis is presented followed by a systematic method of analysis that is used to study the effect of the Aswan dam on the average annual flows of the Nile River. The analysis shows that a significant drop in the flow occurred in 1903 when the dam was brought into operation. Transfer function parameter estimates statistically describe the intervention effect while the stochastic intervention model developed can be used for forecasting and simulation. It is maintained that the potential of intervention analysis in water resources is extensive. (Bell-Cornell)
W76-03165

HYDROLOGY AND CIRCULATION PATTERNS IN THE VICINITY OF OREGON INLET AND ROANOKE ISLAND, NORTH CAROLINA,
North Carolina State Univ., Raleigh. Dept. of Geosciences.
J. J. Singer, and C. E. Knowles.
Report, UNC-SG-75-15, June 1975. 171 p, 38 fig, 8 tab. NOAA Grant 04-3-158-40.

Descriptors: Hydrology, *Flow, *River flow, *Streamflow, Hydrologic data, Floods, Hydrography, On-site data collections, Currents(Water), Circulation, Flow duration, Thermal properties, Hypolimnion, Wind velocity, Upwelling, *North Carolina.
Identifiers: *Circulation patterns, *Oregon Inlet(NC), *Roanoke Island(NC), Thermographic data, Bottom waters, Ebbs, Wind reversals, Oceanic upwelling, Water salinity, Sea Grant Program.

The hydrology and circulation data compiled in the study encompassed three major areas of interest. These included flow in Roanoke and Croatan Sounds, the influences of wind on ebb and flood at Oregon Inlet, and thermographic data collected at Oregon Inlet. The flow of bottom waters in Croatan Sound and in mid-Roanoke Sound was observed to be essentially a direct response to the prevailing winds, except where the winds had prevailed for in excess of 24 to 36 hours causing pileup and subsequent flow reversal. In north Roanoke Sound, the flow of bottom waters south during northerly winds was observed to be essen-

tially non-existent. In south Roanoke Sound, the flow was observed to be influenced by both the winds and flood tides at the inlet. In conjunction with this interaction in south Roanoke Sound, a mechanism was proposed for the northerly penetration of high salinity waters northward through Roanoke Sound towards Albemarle Sound. Both extended ebbs (missed floods) and extended floods (missed ebbs) were recorded at Oregon Inlet. The initiation of these events was observed to be not nearly so dependent on long durations of high wind speeds as previously thought. In fact, rapid wind reversals were noted as apparently enhancing the likelihood of such events. (NOAA)
W76-03178

RUNOFF MEASUREMENT IN SMALL CATCHMENT AREAS: REGISTRATION AND PRESENTATION OF DATA, (IN NORWEGIAN),
Norges Landbrukshoegskole, Vollebekk.
O. Kaarstad.
Forsk Fors Landbruket, Suppl, p 1-102, 1972, Illus. English summary.

Descriptors: *Runoff, *Agricultural runoff, Flood discharge, *Drainage, Drains, Drainage engineering, Watersheds(Basins), *Data collections, Measurement.

Data are given on: a summary of 72 gaging stations; hours the runoff exceeded certain limits during the summer, winter and the hydraulic year; flood peaks, all numbers given as l/s ha; total runoff for the summer, winter and the hydraulic year; interruptions in the measurements. The purpose was to get basic information for hydraulic design of open and closed drainage for agriculture.--Copyright 1974, Biological Abstracts, Inc.
W76-03280

HYBRID FORMULATION OF KINEMATIC WAVE MODELS OF WATERSHED RUNOFF,
New Mexico Institute of Mining and Technology, Socorro.
V. P. Singh.
Journal of Hydrology, Vol 27, No 1/2, p 33-50, October 1975. 10 fig, 2 tab, 14 ref, 1 append.

Descriptors: *Rainfall-runoff relationships, *Overland flow, *Surface runoff, *Model studies, Watersheds(Basins), Rainfall disposition, Runoff, Hydrographs.
Identifiers: *Kinematic wave models, Analytical solutions, Numerical solutions, Hybrid approach, Watershed geometry.

In application of kinematic wave models of watershed runoff, either numerical or analytical solutions are employed, depending on type of input (rainfall pattern) and representation of basin geometry. Analytical solutions require extremely restrictive assumptions which diminish their utility; numerical solutions are less restrictive but are time-consuming. A hybrid approach, incorporating both numerical and analytical methods in the solution of a single problem, was proposed. It was demonstrated to be more efficient than a numerical approach alone, and more generally applicable than an analytical approach alone. Several existing models were evaluated and revised to correspond to the hybrid approach, and one of these revised models was used to analyze a set of rainfall-runoff events on a natural watershed as a demonstration of the computational efficiency of this approach. (Bender-ISWS)
W76-03355

REPRESENTATIVE DISCHARGES FOR GRAVEL-BED RIVERS IN ALBERTA, CANADA,
New Brunswick Univ., Fredericton. Dept. of Civil Engineering.
D. I. Bray.
Journal of Hydrology, Vol 27, No 1/2, p 143-153, October 1975. 4 fig, 3 tab, 13 ref.

Descriptors: *Discharge(Water), *Streamflow, *Channel morphology, *Channel flow, *Canada, River beds, Rivers, Geomorphology, Hydrology, Channels, Beds.
Identifiers: *Dominant discharge, *Representative discharge, *Gravel-bed rivers, Mobile-bed channel, Alberta.

Dominant discharge may be defined as the steady discharge which could form or maintain the average geometric properties of a mobile-bed channel. For practical purposes, dominant discharge may be approximated by a representative discharge based on a hydrological definition or based on the stage corresponding to an identifiable geomorphic feature. An analysis of 71 relatively stable gravel-bed river reaches in Alberta, Canada, was utilized as the basis for adopting the 2-year flood (log-normal analysis) as the representative discharge when considering a hydrologically based definition. The discharge corresponding to the elevation of the valley flat was considered to be the representative discharge for channels which are not excessively entrenched when considering a geomorphologically based definition. (Bender-ISWS)
W76-03357

ALLOMETRIC CHANGE OF LANDFORMS,
Arizona Univ., Tucson. Dept. of Geosciences.
For primary bibliographic entry see Field 4A.
W76-03384

HURRICANE AGNES RAINFALL AND FLOODS, JUNE-JULY 1972,
Geological Survey, Reston, Va; and National Weather Service, Silver Spring, Md.
J. F. Bailey, J. L. Patterson, and J. L. H. Paulhus.
Available from Supt of Documents, GPO, Wash, DC 20402, price $9.10. Professional Paper 924, 1975. 403 p, 59 fig, 1 plate, 8 tab, 34 ref.

Descriptors: *Hurricanes, *Floods, *Flood data, *Northeast U.S., *Southeast U.S., Reviews, Hydrologic data, Flood frequency, Flood damage, Streamflow, Rainfall, Runoff, Flow measurement, Peak discharge, Flood stages, Flood flow, Flood profiles, Flow duration, Flood recurrence interval.
Identifiers: *Hurrican Agnes(1972).

Hurricane Agnes originated in the Caribbean Sea region in mid-June 1972. Torrential rain caused record-breaking floods which occured in the Middle Atlantic States in late June and early July 1972. Many streams in the affected area experienced peak discharges several times the previous maxima of record. Estimated recurrence intervals of peak flows at many gaging stations on major rivers and their tributaries exceeded 100 years. The suspended-sediment concentration and load of most flooded streams were also unusually high. The widespread flooding from this storm caused Agnes to be called the most destructive hurricane in United States history, claiming 117 lives and causing damage estimated at $3.1 billion in 12 states. Damage was particularly high in New York, Pennsylvania, Maryland, and Virginia. The detailed life history of Hurricane Agnes, including the tropical depression and tropical storm stages, is traced. (Woodard-USGS)
W76-03397

THE CHANNELS AND WATERS OF THE UPPER SALMON RIVER AREA, IDAHO,
Geological Survey, Boise, Idaho.
W. W. Emmett.
Available from the Supt. of Documents, GPO, Wash., DC 20402, Price $3.05.

Descriptors: *Hydrologic data, *Streamflow, *Water quality, *Natural streams, *Idaho, Geology, Topography, Climates, Vegetation, Land use, Gaging stations, Runoff, Channel morphology, Flow characteristics, Water resources, Peak discharge, Low flow, Average flow, Sediment transport, Water temperature, Chemical properties.
Identifiers: *Upper Salmon River area(Idaho), Bankful.

The upper 1,800 sq mi of the Salmon River drainage area in south-central Idaho has a little disturbed, natural environment, where for the most part the surface waters are in a pristine state. The magnitude of high- and low-flow stream characteristics is presented in terms of the ratio of discharge to bankful discharge, and the frequency and duration characteristics of these flows are approximately the same for all streams in the area. A recurrence interval of 2 years implies a normal or median year; that is, half the years should produce higher flow, and the remainder should produce lower flow. The median year will have a peak streamflow of about 120 percent of bankful discharge. Likewise, this median year should have 30 consecutive days with a mean discharge of 90 percent or more of bankful and 90 consecutive days with a mean discharge of 60 percent or more of bankful. Conversely, in the low-flow season, the median year should have 30 consecutive days with a mean discharge of 8.2 percent or less of bankful and 90 consecutive days with a mean discharge of 9.0 percent or less of bankful. Stream waters are mostly calcium bicarbonate, and the waters generally are of high quality. (Woodard-USGS)
W76-03405

GUIDELINES FOR FLASH FLOOD AND SMALL TRIBUTARY FLOOD PREDICTION,
National Weather Service Forecast Office, Washington, D.C.
For primary bibliographic entry see Field 4A.
W76-03417

WAVE TRANSFORMATIONS OVER A SLOPING BOTTOM AND OVER A THREE-DIMENSTIONAL SHOAL,
Hawaii Univ., Honolulu. Dept. of Ocean Engineering.
For primary bibliographic entry see Field 2L.
W76-03421

2F. Groundwater

ECONOMIC EFFECTS OF LAND SUBSIDENCE DUE TO EXCESSIVE GROUNDWATER WITHDRAWAL IN THE TEXAS GULF COAST AREA,
Texas A and M Univ., College Station. Water Resources Inst.
For primary bibliographic entry see Field 4B.
W76-03099

AQUIFER EVALUATION USING DEPOSITIONAL SYSTEMS: AN EXAMPLES IN NORTH-CENTRAL TEXAS,
Dames and Moore, Boca Raton, Fla.
W. D. Hall, and L. J. Turk.
Ground Water, Vol 13, No 6, p 472-483, November-December 1975. 14 fig, 3 tab, 18 ref.

Descriptors: *Aquifer systems, *Geohydrologic units, *Water quality, *Hydrogeology, *Texas, Sandstones, Geochemistry, Water resources, Aquifer characteristics, Transmissivity, Groundwater, Hydraulic conductivity, Permeability, Facies(Sedimentary) Geologic formations.
Identifiers: *Depositional system, *Chemical composition, Hosston sandstone, Hensel sandstone.

Delineation of major depositional systems and their component facies within the Lower Cretaceous Hosston and Hensel Sandstones provides a model for predicting the distribution and chemical composition of water in the aquifer. Two major depositional trends occur in the Hosston Formation: (1) a dip-oriented meanderbelt fluvial

system which supplied sediment to (2) a strike-oriented, hightdestructive, wave-dominated delta system in the east. The Hensel deposits prograded eastward across the featureless upper surface of the Pearsall Formation, forming two depositional systems similar to those of the Hosston . The meanderbelt sandstone facies of the fluvial systems and the coastal barrier facies of the delta systems are capable of supplying greater amounts of groundwater than the floodbasin, lagoon-marsh-embayment, or prodelta/shelf facies. Groundwater is dominantly of the calcium-magnesium bicarbonate type in the fluvial systems but changes downdip to sodium sulfate and sodium bicarbonate types in the delta systems. The change in chemical equilibrium probably occurs as domomite-rich waters from the fluvial facies percolate downdip and dissolve anhydrite or oxidize pyrite in lagoonal facies within the delta system, and calcium may be exchanged for sodium on the marine clays. (Sanderson-ISWS)
W76-03111

DETERMINING OPTIMAL WELL DISCHARGE,
Colorado State Univ., Fort Collins.
For primary bibliographic entry see Field 4B.
W76-03118

A STOCHASTIC-CONCEPTUAL ANALYSIS OF ONE-DIMENSIONAL GROUNDWATER FLOW IN NONUNIFORM HOMOGENEOUS MEDIA,
British Columbia Univ., Vancouver. Dept. of Geological Sciences.
R. A. Freeze.
Water Resources Research, Vol 11, No 5, p 725-741, October 1975. 19 fig, 1 tab, 37 ref.

Descriptors: *Stochastic processes, *Groundwater movement, *Non-uniform flow, *Statistical models, Homogeneity, Porous media, Monte Carlo method, Saturated flow, Parametric hydrology, Hydraulic conductivity, Compressibility, Porosity, Distribution patterns, Spatial distribution, Aquifer characteristics, Correlation analysis, Aquifers, Consolidation, Steady flow, Unsteady flow.
Identifiers: One-dimensional flow, Mean, Standard deviation, Boundary value problems, Hydraulic head, Equivalent aquifer.

The most realistic representation of a naturally occurring porous medium is a stochastic set of macroscopic elements in which the values of the three basic parameters (hydraulic conductivity, compressibility, and porosity) are defined by frequency distribution. All soils and geologic formations show random variations in the values of these parameters through space, and a measure of the nonuniformity is provided by the standard deviation of the frequency distributions. The analysis of groundwater flow in nonuniform media requires a stochastic-conceptual approach in which the effects of stochastic parameter distributions on predicted hydralic heads are analyzed with the aid of a set of Monte Carlo solutions to the pertinent boundary value problems. In this study, two one-dimensional saturated flow problems were analyzed: steady state flow between two specified heads and transient consolidation of a clay layer. The primary output was the statistical distribution of hydraulic head. Results showed that the standard deviations of the input hydrogeologic parameters are important index properties. For transient flow, the output distribution of hydraulic head values is almost never normal. The results of the study questioned the validity of the underlying assumption of deterministic groundwater modelling that a single value for each flow parameter can define an 'equivalent' uniform porous medium. (Visocky-ISWS)
W76-03128

THE GALERKIN METHOD FOR NONLINEAR PARABOLIC EQUATIONS OF UNSTEADY GROUNDWATER FLOW,
California Univ., Los Angeles. Dept. of Engineering Systems.
Y. S. Yoon, and W. W-G. Yeh.
Water Resources Research, Vol 11, No 5, p 751-754, October 1975. 2 fig, 15 ref.

Descriptors: *Unsteady flow, *Equations, *Groundwater movement, *Finite element analysis, Analytical techniques, Numerical analysis, Mathematical studies, Aquifers, Surface-groundwater relationships, Homogeneity, Isotropy, Water table, Specific yield, Hydraulic conductivity.
Identifiers: *Galerkin method, Newton method, Nonlinear parabolic equations, Boundary conditions, Predictor-corrector techniques, Weighting functions.

A relatively simple way was suggested for solving nonlinear parabolic partial differential equations associated with unsteady groundwater flow. The Galerkin formulation was discretized in the space domain by using piecewise polynomial equations, and the trapezoidal formula was employed to approximate the time derivative. The resulting system of nonlinear equations was then solved by the Newton method. Rapid rate of convergence and easy computer implementation were demonstrated by numerical examples. Results compared favorably with published experimental data. (Visocky-ISWS)
W76-03129

ISOTOPIC COMPOSITION OF GROUNDWATER IN SEMI-ARID REGIONS OF SOUTHERN AFRICA,
National Physical Research Lab., Pretoria (South Africa).
For primary bibliographic entry see Field 2K.
W76-03130

ECONOMIC ASPECTS OF GEOELECTRICAL PROSPECTING IN SANDSTONE AQUIFERS,
Birmingham Univ. (England). Dept. of Geological Sciences.
For primary bibliographic entry see Field 4B.
W76-03276

THE USE OF A DIGITAL MODEL IN THE MANAGEMENT OF THE CHALK AQUIFER IN THE SOUTH DOWNS, ENGLAND,
Department of the Environment, Reading (England). Central Water Planning Unit.
For primary bibliographic entry see Field 4B.
W76-03356

APPLICATIONS OF ELECTRO-OSMOSIS TO GROUND-WATER FLOW PROBLEMS,
University Coll. of Swansea (Wales). Dept. of Civil Engineering.
R. W. Lewis, C. Humpheson, and J. C. Bruch, Jr.
Ground Water, Vol 13, No 6, p 484-491, November-December 1975. 7 fig, 16 ref. NSF GK-42356.

Descriptors: *Electro-osmosis, *Groundwater movement, *Soil water movement, *Computer models, Confined water, Artificial recharge, Recharge wells, Water wells, Finite element analysis, Electrodes, Anodes, Cathodes, Electric fields, Numerical analysis, Groundwater, Aquifers.
Identifiers: *Confined aquifer, Electrokinetic forces, Hydrodynamic forces.

The solution of two-dimensional groundwater flow in soils of low hydraulic conductivity under the influence of both electrokinetic and hydrodynamic forces was found using the finite element method. The example investigated dealt with a confined aquifer in which there is a recharging as well as a discharging well present. The results demonstrated the effect of the application of the electro-osmosis phenomenon. The formulation is general and permits the analysis of not only arbitrary shaped boundaries but also different electrode configurations. (Sanderson-ISWS)
W76-03362

C. E. JACOB'S STUDY ON THE PROSPECTIVE AND HYPOTHETICAL FUTURE OF THE MINING OF THE GROUND WATER DEPOSITED UNDER THE SOUTHERN HIGH PLAINS OF TEXAS AND NEW MEXICO,
New Mexico Inst. of Mining and Technology, Socorro.
For primary bibliographic entry see Field 4B.
W76-03363

OPTIMAL IDENTIFICATION OF PARAMETERS IN AN INHOMOGENEOUS MEDIUM WITH QUADRATIC PROGRAMMING,
California Univ., Los Angeles.
W. W-G. Yeh.
Society of Petroleum Engineers Journal, Vol 15, No 5, p 371-375, October 1975. 3 tab, 15 ref.

Descriptors: *Aquifer characteristics, *Parametric hydrology, *Model studies, *Analytical techniques, *Unsteady flow, Computer models, Mathematical models, Aquifer systems, Transmissivity, Numerical analysis, Groundwater, Equations, Groundwater basins, Groundwater movement, Flow nets.
Identifiers: Parameter identification, *Nonhomogeneous aquifers, Inverse problem, *Quadratic programming, Method of successive approximations.

This paper developed a new algorithm for parameter identification in a partial differential equation associated with an inhomogeneous aquifer system. The parameters chosen for identification were the storage coefficient, a constant, and transmissivities, functions of the space variable. An implicit finite-difference scheme was used to approximate the solutions of the governing equation. A least-squares criterion was then established. Using distributed observations on the dependent variable within the system, parameters were identified directly by solving a sequence of quadratic programming problems such that the final solution converged to the original problem. The advantages of this new algorithm include rapid rate of convergence, ability to handle any inequality constraints, and easy computer implementation. The numerical example presented demonstrated the simultaneous identification of 12 parameters in only seconds of computer time. (Prickett-ISWS)
W76-03369

AN AQUIFER MODEL FOR FISSURED RESERVOIRS,
Shell Development Co. Houston, Tex.
P. J. Closmann.
Society of Petroleum Engineers Journal, Vol 15, No 5, p 385-398, October 1975. 9 fig, 4 tab, 17 ref, 2 append.

Descriptors: *Model studies, *Fissures(Geologic), *Computer models, *Aquifers, *Numerical analysis, Fracture permeability, Equations, Mathematical models, Analytical techniques, Porosity, Fractures(Geologic), Karst hydrology, Carbonate rocks.
Identifiers: *Fissured reservoirs, Matrix permeability, Petrophysical properties, Reservoir performance, *Aquifer models.

A model was developed for describing aquifer influx in a fissured reservoir. This model included petrophysical properties of good and poor rock, as well as fissure parameters. For the applications considered thus far, it was found that flow in the fissures dominates the aquifer performance and that rock properties and spacing between fissures are of lesser importance. For a given aquifer, the

fissure permeability and fissure volume fraction appear to be important parameters, as are rock permeability and porosity in cases of a high percentage of poor rock. (Prickett-ISWS)
W76-03370

PULSE-TESTING RESPONSE FOR UNEQUAL PULSE AND SHUT-IN PERIODS,
Amoco Production Co. Tulsa, Okla.
For primary bibliographic entry see Field 4B.
W76-03371

MIXING OF THERMAL AND NONTHERMAL WATERS IN THE MARGIN OF THE RIO GRANDE RIFT, JEMEZ MOUNTAINS, NEW MEXICO,
Geological Survey, Albuquerque, N. Mex.
For primary bibliographic entry see Field 2K.
W76-03393

CHEMICAL QUALITY OF GROUND WATER IN THE NORTHERN PART OF THE ALBUQUERQUE-BELEN BASIN, BERNALILLO AND SANDOVAL COUNTIES, NEW MEXICO,
Geological Survey, Albuquerque, N. Mex.
For primary bibliographic entry see Field 5B.
W76-03394

MAP OF THE ANTELOPE VALLEY-EAST KERN WATER AGENCY AREA, CALIFORNIA, SHOWING GROUND-WATER SUBUNITS AND AREAS, LOCATION OF WELLS, AND WATER-LEVEL CONTOURS FOR SPRING 1975,
Geological Survey, Garden Grove, Calif.
For primary bibliographic entry see Field 7C.
W76-03396

MAP SHOWING GROUND-WATER CONDITIONS IN THE WATERMAN WASH AREA, MARICOPA AND PINAL COUNTIES, ARIZONA--1975,
Geological Survey, Phoenix, Ariz.
For primary bibliographic entry see Field 7C.
W76-03399

ANALOG MODEL STUDY OF THE HYDROLOGY OF THE SAN LUIS VALLEY, SOUTH-CENTRAL COLORADO,
Geological Survey, Denver, Colo.
For primary bibliographic entry see Field 4B.
W76-03403

2G. Water In Soils

HEAT AND MASS TRANSFER IN COLD REGION SOILS,
Alaska Univ., College. Inst. of Water Resources.
D. L. Kane, J. N. Luthin, and G. S. Taylor.
Available from the National Technical Information Service, Springfield, Va 22161 as PB-248 457, $4.50 in paper copy, $2.25 in microfiche. Publication No IWR-65, June 1975. 50 p, 21 fig, 15 ref, 2 append. OWRT A-053-ALAS(1). 14-31-0001-5002.

Descriptors: *Soils moisture, *Permafrost, *Snow cover, *Model studies, *Heat transfer, Soil temperature, Moisture content, Pore pressures, Subarctic, Snowpack, Alaska temperature, Forest fires, Computer models, *Mass transfer, *Burning, Cold regions, Organic matter.
Identifiers: Black spruce(Picea-Mariana).

Many parts of interior Alaska have a fire-dominated environment. It has been recognized that there are many beneficial effects of fire; consequently, the past fire control philosophy has been altered. Prescribed and controlled burning are being considered under the new approach. The more intense burns occur in the black spruce (Picea-Mariana) forests which are characterized by a thick organic layer and a shallow mineral soil underlain by permafrost. From field data, it is clear that both the thermal and moisture regimes undergo considerable alteration due to a fire. The degree to which these systems are influenced depends upon many factors, primarily that of the intensity of the burn. Soil temperatures in the burned area are much higher than those in the unburned areas in both summer and winter. The impact on the soil moisture regime is not as evident as that on the thermal regime. The total moisture content is a soil column of a burned site shows a slight increase over a similar unburned site, apparently reflecting the decrease in plant transpiration. A conceptual model of the long-term effects is presented. In addition, a two-dimensional flow model is applied to saturated flow conditions in the organic layer. This organic layer acts as a buffer to both heat and moisture flow, and therefore the destruction of this layer is responsible for changes to the physical system. (See also W76-03002)
W76-03001

WINTER SOIL WATER DYNAMICS,
Alaska Univ., College. Inst. of Water Resources.
D. L. Kane.
Available from the National Technical Information Service, Springfield, Va 22161 as PB-248 458, $3.50 in paper copy, $2.25 in microfiche. Publication No IWR-70, December 1975. 10 p, 3 fig. OWRT A-053-ALAS(2). 14-31-001-5002.

Descriptors: *Soil moisture, *Snow cover, *Permafrost, *Soil temperature, *Pore pressures, Snowpack temperatures, Instrumentation, Subarctic, *Soil water, *Burning, Cold regions.

This study was carried out in conjunction with another study, the objective of which was to determine the effect of fire on the near-surface thermal and soil moisture regimes. The goal of this project was to collect field data on the thermal and moisture regimes over a winter season, with emphasis on the measurement of soil pore pressures and changes in the soil moisture content. Soil tension measurements in advance of the freezing front were made on two sites, one a burned site and the other an unburned natural site, until midwinter. Two techniques were used to measure soil tensions: one contained an antifreeze solution in the porous cup tensiometer, while the other contained water. A very rapid rise in pore pressures occurred immediately after the onset of freeze-up. Later, the difference in pore pressures at depth was such that the hydraulic gradient reversed direction. Under these conditions, soil moisture moves toward the ground surface with such movement resulting in moisture depletion during the winter. Data on the movement of soil water, as well as on the soil condition during the spring break-up, are vital to an understanding of the many engineering and hydrologic problems that develop in cold regions. (See also W76-03001)
W76-03002

TIME-DEPENDENT LINEARIZED INFILTRATION: II. LINE SOURCES,
Arizona Univ., Tucson. Dept. of Mathematics.
D. O. Lomen, and A. W. Warrick.
Soil Science Society of America Proceedings, Vol 38, No 4, p 568-572, July-August, 1974. 6 fig, 12 ref. OWRT B-035-ARIZ(3).

Descriptors: *Infiltration, *Soil water movement, *Mathematical studies, *Unsaturated flow, *Soil water, Irrigation practices, Irrigation effects, Irrigation systems, Irrigation, Agriculture, Irrigation water.
Identifiers: *Trickle irrigation, *Drip irrigation, *Transient flow.

Water flow from line sources is analyzed using a linearized form of the moisture flow equation. Both single and parallel line sources are considered. Results are particularly relevant for high-frequency irrigation such as by trickle sources, for which the soil moisture at any particular point varies over a relatively small range. Numerical calculations include lines of constant matric flux potential (or equal moisture content) as a function of time and the time-dependent response to a cyclic input. Although the results are developed for surface sources, the analysis may easily be extended to buried sources. (Skogerboe-Colorado State)
W76-03007

SOLUTION TO THE ONE-DIMENSIONAL LINEAR MOISTURE FLOW EQUATION WITH WATER EXTRACTION,
Arizona Univ., Tucson. Dept. of Soils, Water and Engineering.
A. W. Warrick.
Soil Science Society of America Proceedings, Vol 38, No 4, p 573-576, July-August, 1974. 3 fig, 2 tab, 8 ref. OWRT B-035-ARIZ(4).

Descriptors: *Soil water movement, *Infiltration, *Mathematical studies, *Unsaturated flow, *Soil water, Irrigation practices, Irrigation effects, Irrigation systems, Irrigation, Agriculture, Irrigation water.
Identifiers: *Trickle irrigation, *Drip irrigation, Matrix flux potential.

The one-dimensional, steady-state moisture flow equation is solved for arbitrary plant water withdrawal functions using the matric flux potential of earlier investigators to obtain a linearized form. A semi-infinite flow medium and a finite-depth medium overlying a shallow water table are considered with the surface boundary condition taken as a flux. Tables are presented giving the matric flux potential (from which the pressure head is easily determined) for several withdrawal functions. Numerical examples show the effects of different surface fluxes and rooting depths on the matric flux potential and pressure-head profiles. The results are particularly relevant for high-frequency irrigation. (Skogerboe-Colorado State)
W76-03008

METHOD OF ESTIMATING MAXIMUM WATER-HOLDING CAPACITY IN SHALLOW SOIL IN A WATERSHED BY PORTABLE SEISMIC PROSPECTING EQUIPMENT,
A. Kikuya, Y. Mashima, and S. Hattori.
Bull Gov For Exp Stn (Tokyo), 270: 77-88, Illus, 1975.

Descriptors: Watersheds(Basins), *Estimating, Methodology, Water storage, Soils, Seismic studies, Equipment.
Identifiers: *Water holding capacity, *Seismic prospecting, *Shallow soils.

One of the important factors affecting the runoff during rainfall and immediately after rainfall is the water-holding capacity in shallow soil layer in forest watershed. This being so, a quantitative method of measuring the factor is demanded. A trial of a method for investigating soil depth and total pore space in a shallow soil layer was conducted by measuring seismic velocity by means of portable seismic prospecting equipment. The relation between dry density (rho s:g/cm3) and seismic velocity (gamma:m/s) of soil was approximately: rho s = 0.179 gamma 0.206. The formula was adopted in the case of soil water content of more than 45% in volume percent. The total pore space in shallow soil layer in a watershed was calculated applying the rho s and total soil volume, and the possibility of estimating the average maximum water-holding capacity in shallow soil layer in a watershed is indicated.--Copyright 1975, Biological Abstracts, Inc.
W76-03063

SOIL WATER HYSTERESIS: TEMPERATURE AND PRESSURE EFFECTS,
Agricultural Research Service, Kimberly, Idaho. Snake River Conservation Research Center.

J. W. Cary.
Soil Science, Vol 120, No 4, p 308-311, October 1975. 2 fig, 1 tab, 7 ref.

Descriptors: *Hysteresis, *Soil moisture, *Soil water, Soil gases, Soil temperature, Air-water interfaces, Microenvironment, Soil physical properties, Clay minerals, Laboratory tests, Pressure, Model studies.
Identifiers: Pore liquid jump model, Silty clay, Loamy sand, Silt loam.

The effects of transient temperatures and pressures on soil water hysteresis were studied under controlled laboratory conditions. Variations in ambient pressure and temperature caused small changes in soil water hysteresis. These changes suggested that at least two mechanisms may be present, neither of which is easily rationalized by the classical hourglass-shaped pore liquid jump model. The variation between duplicate samples of a silty clay, a silt loam, and a loamy sand suggested that normal temperature and pressure changes in the field will not cause changes in soil water hysteresis that are larger than those due to natural soil heterogeneity. Consequently, soil water hysteresis curves measured in the laboratory on representative samples may be used in computer models of field situations. (Gibb-ISWS)
W76-03110

FLUOMETURON AND WATER CONTENT DISTRIBUTIONS DURING INFILTRATION: MEASURED AND CALCULATED,
Oklahoma State Univ., Stillwater. Dept. of Agronomy.
For primary bibliographic entry see Field 5B.
W76-03123

SEASONAL VARIABILITY OF RAINWATER REDISTRIBUTION BY FIELD SOILS,
Birkbeck Coll., London (England).
I. Reid.
Journal of Hydrology, Vol 25, No 1/2, p 71-80, April 1975. 4 fig, 3 tab, 31 ref.

Descriptors: *Rainfall disposition, *Infiltration, *Soil moisture, Moisture content, Antecedent moisture content, Field capacity, Hysteresis, Soil moisture meters, Permeability, Soil-water-plant relationships, Variability, Seasonal.
Identifiers: *North Yorkshire(England).

Seasonal differences in post-infiltration redistribution of rainwater were evaluated for highly porous pasture soils. Winter soil drainage is precipitation-dependent, while soil-moisture fluctuations are a function of the relationship between antecedent soil water-content and the seasonal mean are are largely independent of infiltration quantities. Summer soil drainage is dependent upon both rainfall and differential soil absorption and was described by a linear multiple regression model. The seasonal nature of redistribution is an important consideration of catchment water disposition, and is useful as a control in the evaluation of optimal irrigation practice under field conditions. Temporal changes in soil-moisture response to rainfall exposed difficulties in the conceptualization of field capacity and soil-moisture deficit. Gibb-ISWS)
W76-03131

MOVEMENT OF HERBICIDES IN SOIL BY MASS FLOW,
Iowa State Water Resources Research Inst., Ames.
For primary bibliographic entry see Field 5B.
W76-03134

CONTROL OF NITROGEN TRANSFORMATIONS IN SOILS,
Iowa State Univ., Ames. Dept. of Agronomy.
For primary bibliographic entry see Field 5B.
W76-03141

FATE OF WASTEWATER PHOSPHORUS IN SOIL,
Robert S. Kerr Environmental Research Lab., Ada, Okla. Water Quality Control Branch.
For primary bibliographic entry see Field 5B.
W76-03250

FATE OF WASTEWATER BACTERIA AND VIRSUSES IN SOIL,
Baylor Coll. of Medicine, Houston, Tex. Dept. of Virology and Epidemiology.
For primary bibliographic entry see Field 5B.
W76-03251

EFFECT OF FALLOUT OF WINDBRONE ZINC, LEAD, COPPER AND CADMIUM FROM A FUMING KILN ON SOIL GEOCHEMICAL PROSPECTING AT BERG AUKAS, SOUTH WEST AFRICA,
Cape Town Univ., South Africa. Dept. of Geochemistry.
For primary bibliographic entry see Field 5B.
W76-03302

GEOCHEMICAL AND BIOGEOCHEMICAL EXPLORATION RESEARCH NEAR EARLY PRECAMBRIAN PORPHYRY-TYPE MOLYBDENUM-COPPER MINERALIZATION, NORTHWESTERN ONTARIO, CANADA,
Ministry of Natural Resources, Toronto, Ontario, Canada. Ontario Division of Mines.
For primary bibliographic entry see Field 5A.
W76-03315

FACING UP TO SLUDGE DISPOSAL IN NEW JERSEY,
For primary bibliographic entry see Field 5E.
W76-03341

THE EFFECT OF TIMBER REMOVAL ON THE STABILITY OF FOREST SOILS,
Forest and Range Experiment Station, Rangiora (New Zealand). Div. of Protection Forestry.
For primary bibliographic entry see Field 4C.
W76-03361

APPLICATIONS OF ELECTRO-OSMOSIS TO GROUND-WATER FLOW PROBLEMS,
University Coll. of Swansea (Wales). Dept. of Civil Engineering.
For primary bibliographic entry see Field 2F.
W76-03362

DYNAMIC SIMULATION OF WATER STORAGE IN FALLOW SOIL AS AFFECTED BY MULCH OF HYDROPHOBIC AGGREGATES,
Texas A and M. Univ., College Station. Dept. of Soil and Crop Sciences; and Texas Agricultural Experiment Station, College Station.
D. I. Hillel, C. H. M. van Bavel, and H. Talpaz.
Soil Science Society of America Proceedings, Vol 39, No 5, p 826-833, September-October 1975. 7 fig, 1 tab, 16 ref, 1 append.

Descriptors: *Dynamic programming, *Storage, *Fallowing, *Mulching, *Soil aggregates, Numerical analysis, Water balance, Cycles, Infiltration, Evaporation, Soil properties, Hydraulic properties, Rainfall intensity, Runoff, Agricultural runoff, Drainage, Moisture content, Soil moisture, Water conservation, Soil management, Water management(Applied), Crop production, Groundwater recharge, Model studies.
Identifiers: *Hydrophobic aggregates, Layers.

A mechanistic numerical model, based on fundamental physical principles and written in IBM S/360 CSMP language, was designed to compute the dynamic balance of water in a fallow soil through repeated cycles of infiltration and evaporation. The necessary inputs are: (1) hydraulic characteristics of the soil and of the surface crust of mulch layer, (2) duration and intensity characteristics of rainstorms or irrigations, and (3) the potential evaporation rate as it varies diurnally and from day to day. The output provides time-dependent rates and cumulative quantities of infiltration, runoff, surface detention, evaporation, internal drainage and changes in water content of different layers and of the profile as a whole. Computations carried out for a 4-day simulation (including two rainstorms and four evaporation cycles) illustrated the use of the model for uniform, crusted or mulched soil and predicted that the presence of a mulch of hydrophobic aggregates, several centimeters thick, can greatly increase the quantity of water absorbed and retained in the profile. This finding accorded with previously-published experimental results and indicated a promising approach to soil management for water conservation in dryland and irrigated farming. (Visocky-ISWS)
W76-03365

RELATIONSHIPS BETWEEN THE HYDRAULIC CONDUCTANCE OF SURFACE CRUSTS AND SOIL MANAGEMENT IN A TYPIC HAPLUDALF,
Soil Survey Inst., Wageningen (Netherlands).
O. Falayi, and J. Bouma.
Soil Science Society of America Proceedings, Vol 39, No 5, p 957-963, September-October 1975. 8 fig, 3 tab, 36 ref.

Descriptors: *Hydraulic conductivity, *Soil management, Runoff, Soil erosion, Cultivation, Rotations, On-site investigations, Simulated rainfall, Soil aggregates, Soil properties, Infiltration, Loam, Equipment, Storage, Pores, Corn(Field), Steady flow, Runoff.
Identifiers: *Soil crusting, Crust test, Soil roughness.

The effect of different soil management, in terms of soil tillage and crop rotation, on soil crusting was investigated by applying continuous artificial rain (8.5 cm/hr) to experimental plots until steady-state conditions were reached. Comparisons were made with bare plots subjected to natural rainfall for a period of 4 months. Significant differences in soil roughness between the plow only and the plow, disk, and harrow treatments resulted in higher infiltration and longer times to incipient runoff for the plow treatment. However, differences in surface roughness and infiltration and runoff rates were insignificant among treatments when steady-state conditions were reached after only 2 hours. Crust conductances, measured in situ, were significantly lower in the plow, disk, and harrow treatments for the sod as compared with the continuous corn rotation. Crusts had a significantly higher conductance when formed on top of clods as compared with crusts formed between clods in the plow treatment. Conductances of crusts formed under short-term high-energy experimental rainfall were not significantly different from those formed under natural conditions, The latter characterized by intermittent low-energy rainfall during a 4-month period. However, their morphology was significantly different. (Visocky-ISWS)
W76-03366

DO HEAVY METALS PREVENT THE AGRICULTURAL USE OF MUNICIPAL SLUDGE,
Royal Danish School of Pharmacy, Copehagen.
For primary bibliographic entry see Field 5E.
W76-03409

COMBINED DAILY CLIMATIC DATA AND DILUTE SOLUTION CHEMISTRY IN STUDIES OF SOIL PROFILE FORMATION,
C. L. Scrivner, J. C. Baker, and D. R. Brees.
Soil Sci. Vol 115, No 3, p 213-223, 1973, Illus.

Descriptors: *Soil moisture, Soil water movement, Soil horizons, Soil chemistry.

A model was developed for converting long-time daily records of temperature and precipitation into daily depths of moistening and drying of the soil. The time-depth distributions of moist and dry zones were summed and converted to a prediction equation of the form, log F = k1 -k2 log D where F is the frequency of completed moist-dry cycles, D is depth, and k1 and k2 are constants characteristics of a particular soil and climate. The average annual amount of excess precipitation that fell when soil moisture was completely recharged the numerical description of the soil moisture regime. The depth that has a frequency of 1 completed moist-dry cycle/yr coincides with the depth of solum in Missouri soils. It appears that the upper boundary of the B horizon is determined by the average depth of penetration of summer rains. Estimated amounts of water passing planes in the soil can be summed by integration of the prediction equation for depth-frequency of completed moist-dry cycles. Analyses of soil solutions produced when dry soil samples were equilibrated with water for 1 wk suggest that alumino-silicate minerals react in a manner that is predicted by chemical thermodynamics. Kaolinite appears to be the stable clay mineral in a wide array of soil horizons including those with large amounts of montmorillonite. Quartz appears to be unstable in some A horizons, in layers adjacent to limestone, and in all horizons of a gibbsitic soil containing quartz.--Copyright 1973, Biological Abstracts, Inc.
W76-03450

SIMULATION OF THE RAINFALL-RUNOFF PROCESS USING A HYSTERETIC INFILTRATION-REDISTRIBUTION MODEL,
New South Wales Univ., Kensington (Australia). School of Civil Engineering.
K. K. Watson, and S. J. Lees.
Australian Journal of Soil Research, Vol 13, No 2, p 133-140, September 1975. 4 fig, 11 ref.

Descriptors: *Model studies, *Hysteresis, *Rainfall-runoff relationships, *Soil moisture, *Infiltration, Water storage, Soil water movement, Moisture content, Watersheds(Basins), Soil profiles.

The significance of the soil profile and its accompanying water status in deterministic catchment models is discussed in relation to the current use of the soil-store concept. An alternative numerical approach is described in which the movement of water into and through the soil profile (together with the determination of runoff volumes) is continuously monitored during any pattern of rainfall and non-rainfall events. A significant component in the approach is the use of a comprehensive domain-type hysteresis model for the analysis of infiltration-redistribution sequences. The simulation is illustrated by using a rainfall hyetograph of 7 hours duration (including one non-rainfall period of 1 hour) as the flux input into a homogeneous profile of a sandy loam of uniform initial water content. The time-dependent relationships of rate of surface flux, depression storage and runoff volume are calculated for the duration of the hyetograph period. Profiles of water content are also presented. (CSIRO)
W76-03451

2H. Lakes

HARVESTING AS A CONTROL FOR AQUATIC PLANTS,
Wisconsin Univ. Extension, Madison.
For primary bibliographic entry see Field 5G.
W76-03058

ENVIRONMENTAL STATUS OF THE LAKE MICHIGAN REGION, VOLUME 2. PHYSICAL LIMNOLOGY OF LAKE MICHIGAN.
Report No ANL/ES-40, Volume 2, Argonne National Laboratory, Illinois, June 1975. 121 p.

Descriptors: *Lake Michigan, *Limnology, *Dispersion, *Diffusion, Lakes, Water levels, Hydrologic, aspects, Heat budget, Stratification, Circulation, Water circulation, Currents(Water), Water balance, Water properties, Water temperature, Waves(Water), Internal waves.

This report is one of a series describing the environmental status of Lake Michigan and its watershed. Broad subject areas included were: (1) physical characteristics of Lake Michigan and its responses to applied forces, and (2) diffusion and dispersion, (See W76-03106 and W76-03107) (Humphreys-ISWS)
W76-03105

PART 1. PHYSICAL CHARACTERISTICS OF LAKE MICHIGAN AND ITS RESPONSES TO APPLIED FORCES,
Wisconsin Univ., Milwaukee. Center for Great Lakes Studies.
C.H. Mortimer.
Environmental Status of the Lake Michigan Region, Volume 2. Physical Limnology of Lake Michigan, Report No. ANL/ES-40, Volume 2, Argonne National Laboratory, Illinois, p 1-102, June 1975. 62 fig, 1 tab, 78 ref.

Descriptors: *Lake Michigan, *Limnology, *Physical properties, Winds, Currents(Water), Temperature, Water temperature, Thermocline, Coriolis force, Upwelling, Hydrologic budget, Water levels, Circulation, Water circulation, Heat budget, Stratification, Internal waves, Waves(Water), Water properties, Lakes, Hydrology.

Representative responses of Lake Michigan to applied wind forces are: (1) wind-driven currents and near-shore geostrophic (Coriolis-balanced) currents, generally unidirectional but subject to frequent direction changes and reversals; and (2) periodic currents generated by waves, principally long internal and surface waves in the form of seiches modified by the earch's rotation, constituting the free modes of oscillation of the basin. After winter circulation, the annual temperature cycle begins with the thermal bar phase of spring warming, followed by stratification in summer and fall. After stratification, wind stress and Coriolis force combine to produce frequent and extensive upwellings. These forces generate geostrophic currents near shore and internal waves of several kinds, including those of near-inertial period (15 to 17 hr) producing rotating currents conspicuous in offshore waters. Near shore, the previously mentioned unidirectional (including Kelvin wave) responses predominate. (See also W76-03105) (Sims-ISWS)
W76-03106

PART 2. DIFFUSION AND DISPERSION,
Woods Hole Oceanographic Institution, Mass.
For primary bibliographic entry see Field 5B.
W76-03107

SURFACE WAVE DATA RECORDED IN LAKE ONTARIO DURING IFYGL,
National Oceanic and Atmospheric Administration, Ann Arbor, Mich. Great Lakes Environmental Research Lab.
For primary bibliographic entry see Field 7C.
W76-03184

INTERNATIONAL FIELD YEAR FOR THE GREAT LAKES.
National Oceanic and Atmospheric Administration, Rockville, Md.
Available from the U.S. IFYGL Project Office, Great Lakes Environmental Research Laboratory, 2300 Washtenaw Avenue, Ann Arbor, MI 48104. IFYGL Bulletin No 15, August 1975, 103 p.

Descriptors: *Great Lakes, *Great Lakes region, *Lakes, Lake Ontario, United States, Canada, *Projects, Publications, *Bibliographies, Lake morphology, Water levels, Water temperature, Currents(Water).
Identifiers: Canadian project reports, Lake-averaged temperatures, Lake currents.

This bulletin contains data for both the United States and Canada. The contents of the report include: IFYGL Bibliography - which contains Official IFYGL Publications, a Bibliography, and Additions to the IFYGL Bibliography; Canadian Project Reports; Canadian IFYGL Data Management Report - which contains a list of IFYGL Data Publications, and Abstracts of IFYGL Papers; Comments by the U.S. Director; Lake-Averaged Temperatures and Currents in Lake Ontario in 1972; Lake Ontario Beginning-of-Month Levels and Changes in Storage; U.S. Scientific Program - which includes Tasks, and Panel Reports; and Data Management - IFYGL Archive.
W76-03189

SEWER SYSTEMS IN THE COMMUNITIES AROUND LAKE SEVAN (SKHEMA KANALIZATSII NASELENNYKH MEST, RASPOLOZHENNYKH VOKRUG OZERA SEVAN),
For primary bibliographic entry see Field 5D.
W76-03195

PREDICTIVE MODEL FOR PHOSPHORUS IN LAKES,
North Carolina Univ., Chapel Hill. Dept. of Environmental Sciences and Engineering.
For primary bibliographic entry see Field 5B.
W76-03243

PRODUCTION OF MACROPHYTES OF SOME LAKES IN THE PSKOV REGION, (IN RUSSIAN),
Akademiya Nauk SSSR, Leningrad. Botanicheskii Institut.
For primary bibliographic entry see Field 5C.
W76-03245

A STRATEGY FOR MANAGEMENT OF MARINE AND LAKE SYSTEMS WITHIN THE NATIONAL PARK SYSTEM.
National Park Service, Washington, D.C. Office of Natural Science.
For primary bibliographic entry see Field 2L.
W76-03296

A FOOD CHAIN MODEL OF CADMIUM IN WESTERN LAKE ERIE,
Manhattan Coll., New York.
For primary bibliographic entry see Field 5B.
W76-03310

MAGNETIC SUSCEPTIBILITY OF LAKE SEDIMENTS,
Edinburgh Univ., (Scotland). Dept. of Geophysics.
For primary bibliographic entry see Field 2J.
W76-03311

STUDIES OF GULL LAKE, MICHIGAN: I. SEASONAL AND DEPTH DISTRIBUTION OF PHYTOPLANKTON,
University of East Anglia, Norwich (England). School of Environmental Sciences.
For primary bibliographic entry see Field 5C.
W76-03338

RANGE AND DEFICIT ANALYSIS USING MARKOV CHAINS,
Colorado State Univ., Fort Collins.
F. L. S. Gomide.
Hydrology Papers, No 79, September 1975. 76 p, 46 fig, 3 tab, 42 ref. NSF GK-31512-X2.

Descriptors: *Reservoir storage, *Stochastic processes, *Synthetic hydrology, *Reservoir operation, Analytical techniques, *Reservoir yield, Mass curves, Model studies, Boundary processes, Water storage, Storage, Queueing theory, Markov processes, *Regulation, *River regulation.
Identifiers: Adjusted range, Accumulated deficits, Hurst phenomenon.

Two properties of the partial sums of random variables were investigated: the range and the maximum accumulated deficit. The range (or the adjusted range) was used in the design of storage capacities for full regulation of river discharges and the maximum accumulated deficit was used in the case of partial regulation. A general approach to the distribution of the range of partial sums of independent random variables was developed. The distribution of the range was shown to follow from the theory of Markov chains, when the state space is such that the boundary states are absorbing. Similarly, a general approach to the distribution of the maximum accumulated deficit of partial sums of independent random variables was developed. The distribution of the maximum accumulated deficit was shown to follow from the theory of Markov chains, when the state space is such that one boundary state is absorbing and the other is reflecting. By analogy, the distribution of the maximum accumulated deficit of partial sums of continuous, independent random variables was obtained. The similarities between range and deficit analysis and Moran's theory of reservoirs were pointed out. Practical applications were discussed and a brief note on the so-called Hurst phenomenon was included. (Singh-ISWS)
W76-03354

THE EFFECT OF BOTTOM TOPOGRAPHY ON A STRATIFIED FLOW IN THE BETA PLANE,
Case Western Reserve Univ., Cleveland, Ohio. Dept. of Fluid, Thermal, and Aerospace Sciences.
G. S. Janowitz.
Journal of Geophysical Research, Vol 80, No 30, p 4163-4168, October 20, 1975. 2 fig, 6 ref. NSF GA-31889.

Descriptors: *Velocity, *Theoretical analysis, *Boundaries(Surfaces), *Ocean currents, Oceans, Currents(Water), Pressure, Equations, Density stratification, Lakes, Drag, Steady flow.
Identifiers: *Bottom topography, Vorticity, Rossby number, Ridges.

For the case of an unsheared stably stratified eastward flow, the mean motion and baroclinic motion were decoupled, the mean motion obeying the barotropic vorticity equation. For small stratification, the baroclinic solution was obtained explicitly. The baroclinic motion had deeper water on the left near the bottom and deeper water on the right near the top in the northern hemisphere. Over a conical topography in the northern hemisphere the barotropic motion was clockwise; the baroclinic motion thus reinforced the barotropic motion near the bottom and opposed it near the top. For an unsheared current with a linear but not necessarily small stratification and an arbitary bottom topography, an explicit solution for the flow was obtained as well as an expression for the net forces exerted by the current on the topography. By using this general solution the specific example of a north-south ridge was computed in detail. This calculation confirmed the general features of the baroclinic motion which were derived for small stratification. (Adams-ISWS)
W76-03378

SOME FEATURES OF WIND ACTION ON SHALLOW LAKES,
Universidad Nacional Autonoma de Mexico, Mexico City. Instituto de Ingenieria.
R. B. Banks.
Journal of the Environmental Engineering Division, American Society of Civil Engineers, Vol 101, No EE5, Proceedings Paper 11640, p 813-827, October 1975. 4 fig, 2 tab, 36 ref, 2 append.

Descriptors: Movement, *Winds, *Water circulation, *Turbulence, *Lagoons, *Lakes, Reaeration, Oxygenation, Diffusion, Mixing, Coriolis force, Wind velocity, Shallow water, Dissolved oxygen, Biochemical oxygen demand, Waves(Water), Aeration, Environmental engineering, Shear stress, *Mexico.
Identifiers: *Lake Chapala(Mexico), *Wind shear, Oxygen transport mechanisms, Velocity distribution, Turbulent diffusion coefficient, Oxygen transfer coefficient, Surface reaeration coefficient.

Wind-induced circulation in lakes and lagoons has substantial influence on the velocity distribution q, which affects the movement of suspended and dissolved substances. Coefficients of turbulent diffusion and surface reaeration are also dependent upon wind action. With the vertical turbulent diffusion coefficient K assumed constant, expressions for q were determine with and without consideration of Coriolis effects, which were subsequently neglected. K was shown to be directly proportional to the wind velocity U if the wind shear stress coefficient C sub f is constant. Investigation of the relationship between the surface reaeration coefficient K sub 2, the oxygen transfer coefficient K sub L, and K domonstrated that both K sub 2 and K sub L are directly proportional to K and thus to U, if C sub f is constant. Further investigation showed that the coefficients K, K sub 2, and K sub L are directly proportional to U to the m power where m = 1/2 for small U, m = 1 for medium U, and m = 2 for large U. (Bender-ISWS)
W76-03380

WATER WAVES GENERATED BY LANDSLIDES IN RESERVOIRS,
Engineers Waterways Experiment Station, Vicksburg, Miss. Wave Branch.
D. D. Davidson, and B. L. McCartney.
Journal of the Hydraulics Division, American Society of Civil Engineers, Vol 101, No HY12, Proceedings Paper 11791, p 1489-1501, December 1975. 10 fig, 2 tab, 8 ref, 1 append.

Descriptors: *Hydraulic models, *Landslides, *Waves(Water), *Montana, Model studies, Hydraulics, Lakes, Reservoirs, Protection.
Identifiers: *Wave height, *Runup, *Lake Koocanusa(Mont), Preventive measures.

A hydraulic model investigation has been conducted to ascertain the magnitude of wave height and runup to be expected from potential landslides in Lake Koocanusa at Libby Dam, Montana. Although this investigation was of a particular site, it furnished valuable information and insight into general problems of waves resulting from landslides that might be pertinent to other areas. The model study results showed the wave heights and runup to be expected at various pool elevations as well as the effect and corrective measures proposed to reduce wave heights to an acceptable level. The Libby prototype problem, model concepts, some experimental data, and conclusions pertinent to the prediction of landslide generated water waves were presented. (Lee-ISWS)
W76-03382

EVAPORATION FROM LAKE ERIE,
National Oceanic and Atmospheric Administration, Boulder, Colo. Environment Research Labs.
For primary bibliographic entry see Field 2D.
W76-03415

U.S. IFYGL SHIPBOARD DATA ACQUISITION SYSTEM,
International Field Year for the Great Lakes Project Office, Rockville, Md.
A. Robertson.
International Field Year for the Great Lakes. Technical Manual Series No. 5, March 1974. 45 p.

Descriptors: Ships, *Great Lakes, *Data collections, *Hydrologic data, Water resources, Exploration, Data processing, Meteorological data, International Hydrological Decade, Water quality, Water resources, Oceanography, Limnology, Data processing.
Identifiers: *Shipboard data acquisition system, *Data acquisition system, *Data processing systems, Water research, Water quantity, Research vessels, Oceanographic research, Environmental parameters, Oceanographic data, Shipboard sensors.

The International Field Year for the Great Lakes (IFYGL) is a joint Canadian-United States program of coordinated environmental and water resources research focused on Lake Ontario and the Ontario watershed basin. The central objective of this program is to strengthen knowledge of this lake and its basin in order to provide a scientific basis for improved Great Lakes management activities related to water quantity, water quality, and environmentally sensitive operations. The IFYGL research activities are organized into six basic scientific programs. Several major data acquisition systems were developed specially for used during IFYGL. Reports are being prepared to document the development and operation of these systems. This present document is one in this sereies and describes the automatic on-board data acquisition systems developed for the major U.S. research vessels used during IFYGL. In this report only the automatic data acquisition systems are considered; the rather conventional procedures used aboard the ships to gather and record data by other means are not described. (NOAA)
W76-03416

CHRONIC MALNUTRITION IN FOUR SPECIES OF SUNFISH IN A THERMALLY-LOADED IMPOUNDMENT,
North Carolina Univ., at Asheville. Dept. of Biology.
For primary bibliographic entry see Field 5C.
W76-03472

MANGROVE-ROOT COMMUNITIES IN A THERMALLY ALTERED AREA IN GUAYANILLA BAY, PUERTO RICO,
Puerto Rico Nuclear Center, Mayaguez.
For primary bibliographic entry see Field 5C.
W76-03487

EFFECT OF THERMAL STRESS ON PHYTOPLANKTON PRODUCTIVITY IN CONDENSER COOLING WATER,
North Carolina University. Dept. of Environmental Sciences and Engineering.
For primary bibliographic entry see Field 5C.
W76-03490

2I. Water In Plants

ESTIMATION OF COOLING POWER IN A DECIDUOUS FOREST STAND,
Polish Academy of Sciences, Bialystok. Mammals Research Inst.
J. L. Olszewski.
Ekol Pol, Vol 20, No 35, p 463-477, 1972, Illus.
Identifiers: *Cooling, *Deciduous forests, *Poland, Power, Thermometers, Velocity, Winds, *Forest stands.

Measurements were made daily, from March 15, 1961-March 15, 1964 by means of a Hill catather-

mometer of cooling power in a deciduous forest stand (QuercoCarpinetum medioeuropaeum) in the Bialowieza National Park (Poland). Seasons were distinguished on the basis of the state of tree foliage and presence or absences of snow cover. Cooling power indices differ fairly distinctly. Comparison was also made of cooling power in the forest stand and in an open area outside it, where the value was found to be twice higher. The chief factor accounting for this is the very low velocity of wind in tree stands.--Copyright 1974, Biological Abstracts, Inc.
W76-03064

SPARTINA REVEGETATION ON DREDGE SPOIL IN SE MARSHES,
Skidaway Inst. of Oceanography, Savannah, Ga.
For primary bibliographic entry see Field 5G.
W76-03121

ATTEMPTS AT A COMPARATIVE ECOLOGIC ANALYSIS OF FAGUS-ABIES FORESTS IN THE SWISS JURA MOUNTAINS (WEISSENTIEN AND CHASSERAL), (IN GERMAN),
For primary bibliographic entry see Field 4A.
W76-03274

DECIDUOUS WOODLANDS IN SJUHARADSBYGDEN (IN SWEDISH),
G. Wallin.
Acta Phytogeogr Suec. 58 p, 1-114. 1973, Illus. (English summary).
Identifiers: Beech, Climates, *Deciduous forests, Floristics, Grasses, Heaths, Quercus-Petraea, Quercus-Robur, Soils, Sweden(Sjuharadsbygden), *Woodlands.

The area is situated in the transition zone between the deciduous and conifer forest in Sweden. The climate is mesic (mean temperature for coldest and warmest month ca. (about) -3 and 15C, precipitation ca. 800 mm). The soil varies from poor to rich. The flora is suboceanic. Heath type oak woods (1 community, 5 variants), meadows type deciduous woods (13 communities, 7 variants) and beech woods (4 communities, 7 variants), were distinguished and 35 localities described. Floristic analyses are given but communities are not ranked. Heath type oak woods (Quercus robur and Q. petraea) occur on high, shallow ground and have a poor ground layer chiefly of dwarf shrubs and tough grasses. Meadow-type deciduous woodland usually occurs on sunny, well-watered slopes among boulders. The undergrowth is rich in sweet grasses and herbs without dwarf shrubs. The beech stands are marginal to the area of distribution of beech, but regenerate well. The ground layer is sparse to absent. The soil of the heath wood is a podzol type, transgrading to a brown earth in the meadow-type. Historical documents indicate that the forests were badly depleted during the last centuries and partly held down by grazing. During the last 100 yr the forests have regenerated.--Copyright 1974, Biological Abstracts, Inc.
W76-03300

2J. Erosion and Sedimentation

THE OFF-SITE SEDIMENT DAMAGE FUNCTION IN SELECTED ILLINOIS WATERSHEDS,
Illinois Univ. at Urban-Champaign. Dept. of Finance.
For primary bibliographic entry see Field 4D.
W76-03126

WIND EROSION: UNIFORMLY SPACING NONERODIBLE ELEMENTS ELIMINATES EFFECTS OF WIND DIRECTION VARIABILITY,
Agricultural Research Service, Manhattan, Kans.
For primary bibliographic entry see Field 4D.
W76-03127

SHORELINE CHANGES BETWEEN SABINE PASS AND BOLIVAR ROADS, AN ANALYSIS OF HISTORICAL CHANGES OF THE TEXAS GULF SHORELINE,
Texas Univ., Austin. Bureau of Economic Geology.
For primary bibliographic entry see Field 2L.
W76-03133

MAJOR AND TRACE ELEMENT ANOMALIES IN STREAM SEDIMENTS OF THE TEIGN VALLEY OREFIELD,
Southampton Univ. (England). Dept. of Geology.
For primary bibliographic entry see Field 5A.
W76-03303

MAGNETIC SUSCEPTIBILITY OF LAKE SEDIMENTS,
Edinburgh Univ., (Scotland). Dept. of Geophysics.
R. Thompson, R. W. Battarbee, P. E. O'Sullivan, and F. Oldfield.
Limnology and Oceanography, Vol 20, No 5, p 687-698, 1975. 14 fig, 12 ref.

Descriptors: *Heavy metals, *Magnetic studies, *Sediment distribution, *Iron compounds, Pollutant identification, Lake sediments.
Identifiers: *Magnetic susceptibility, Sediment cores, *Detrital magnetite, Nondestructive measurements.

Initial magnetic susceptibility in Flandrian sediments from Lough Neagh, Northern Ireland is shown to be a function of the detrital titanomagnetite of the sediment. There is some correspondence between peaks in iron concentration and high susceptibility measurements. These presumably represent levels where a major contributor to the iron content of the sediment is detrital magnetite. Parallel susceptibility changes are synchronous from core to core and thus potentially valuable for core correlation especially in view of the rapid nondestructive measuring technique. Changing susceptibility in the lake sediments studied appears to be positively correlated with variations in the amount of inwashed inorganic allochthonous material present in the cores. (Gregory-Vanderbilt)
W76-03311

DESCRIPTION OF SEASONAL BEACH CHANGES USING EMPIRICAL EIGENFUNCTIONS,
Scripps Institution of Oceanography, San Diego, Calif.
For primary bibliographic entry see Field 2L.
W76-03377

ALLOMETRIC CHANGE OF LANDFORMS,
Arizona Univ., Tucson. Dept. of Geosciences.
For primary bibliographic entry see Field 4A.
W76-03384

INDEX OF SURFACE WATER QUALITY RECORDS TO SEPTEMBER 30, 1973, SOUTHEAST ALASKA,
Geological Survey, Anchorage, Alaska.
For primary bibliographic entry see Field 7C.
W76-03400

FE-MN OXIDE COATINGS IN STREAM SEDIMENT GEOCHEMICAL SURVEYS,
Georgia Univ., Athens. Dept. of Geology.
For primary bibliographic entry see Field 5B.
W76-03412

2K. Chemical Processes

THE TIME STABILITY OF DISSOLVED MERCURY IN WATER SAMPLES--II. CHEMICAL STABILIZATION,
Geological Survey, Menlo Park, Calif.
For primary bibliographic entry see Field 5A.
W76-03009

ISOTOPIC COMPOSITION OF GROUNDWATER IN SEMI-ARID REGIONS OF SOUTHERN AFRICA,
National Physical Research Lab., Pretoria (South Africa).
J. C. Vogel, and H. Van Urk.
Journal of Hydrology, Vol 25, No 1/2, p 23-36, April 1975. 8 fig, 1 tab, 27 ref.

Descriptors: *Isotope studies, *Deuterium, *Groundwater, *Oxygen isotopes, *Africa, Stable isotopes, Carbon radioisotopes, Rainfall intensity, Chemistry of precipitation, Groundwater recharge, Infiltration.
Identifiers: Southern Africa.

Although the isotope content of precipitation in the semi-arid regions of southern Africa is extremely variable, groundwater samples from the same district were found to have a remarkably constant isotopic composition. The oxygen-18 content of the underground water, in general, varies by about 0.5% in given area. The differences that occur between different regions are sufficiently large to allow the groundwater of an area to be characterized by means of its oxygen-18 content. In order to localize the infiltration area of an aquifer, radiocarbon dating of the water was used. It appeared that the groundwater contains, in general, less of the heavy isotopes than takes place during periods of heavy rainfall. Examples were given where the isotope content of the groundwater is used to distinguish between different aquifers in the same region. (Gibb-ISWS)
W76-03130

A NEUTRON SCATTERING STUDY OF WATER AND IONIC SOLUTIONS - 1967, FIRST REPORT,
Union Carbide Corp., Tuxedo, N. Y. Sterling Forest Research Center.
For primary bibliographic entry see Field 1B.
W76-03260

A NEUTRON SCATTERING STUDY OF WATER AND IONIC SOLUTIONS,
Union Carbide Corp., Tuxedo, N.Y.
For primary bibliographic entry see Field 1B.
W76-03261

DETERMINATION OF TUNGSTEN IN GEOLOGIC MATERIALS BY NEUTRON ACTIVATION ANALYSIS,
Geological Survey, College Park, Md.
For primary bibliographic entry see Field 5A.
W76-03309

APPLICATION OF THE STAINTON SYRINGE METHOD TO THE ANALYSIS OF MERCURY IN NATURAL WATERS,
Fisheries and Marine Service, West Vancouver (Brittish Columbia). Pacific Environmental Inst.
For primary bibliographic entry see Field 5A.
W76-03313

GEOCHEMICAL AND BIOGEOCHEMICAL EXPLORATION RESEARCH NEAR EARLY PRECAMBRIAN PORPHYRY-TYPE MOLYBDENUM-COPPER MINERALIZATION, NORTHWESTERN ONTARIO, CANADA,
Ministry of Natural Resources, Toronto, Ontario, Canada. Ontario Division of Mines.
For primary bibliographic entry see Field 5A.

W76-03315

A SUMMARY OF THE BIOGEOCHEMISTRY OF NITROGEN COMPOUNDS IN GROUND WATER,
California State Univ., Chico.
For primary bibliographic entry see Field 5B.
W76-03358

HEXAVALENT CHROMIUM IN THE GROUND WATER IN PARADISE VALLEY, ARIZONA,
Delaware Univ., Newark. Water Resources Center.
For primary bibliographic entry see Field 4B.
W76-03364

MIXING OF THERMAL AND NONTHERMAL WATERS IN THE MARGIN OF THE RIO GRANDE RIFT, JEMEZ MOUNTAINS, NEW MEXICO,
Geological Survey, Albuquerque, N. Mex.
F. W. Trainer.
In: New Mexico Geological Society Guidebook, 26th Field Conference, Las Cruces County, p 213-218, 1975. 3 fig, 2 tab, 12 ref.

Descriptors: *Chemical analysis, *Groundwater, *Thermal springs, *Cold springs, *Mixing, *New Mexico, Geochemistry, Hydrogeology, Groundwater movement, Water types, Water quality, Chemical properties, Chemical reactions.
Identifiers: *Jemez Mountains(N Mex).

Chemical analyses of groundwater from the marginal fault zone of the Rio Grande rift, in the southwestern Jemez Mountains, N. Mex., show that thermal water from depth mixes with local groundwater. Mixing of the waters provides evidence of groundwater flow paths in this part of the rift, and general conclusions reached in study of the mixing may be useful in investigations of thermal waters elsewhere. Water in alluvium along the Jemez River is derived principally from dilute groundwater in volcanic rocks, but many points representing samples of water from the alluvium fall outside the field typical of dilute water in the volcanic rocks. The reason for this atypical composition is clear: this water occurs down-canyon from mineral springs in the canyon floor, and the water is a mixture of local groundwater and of mineral water from the springs and probably from faults beneath the alluvium. Groundwater in carbonate rock in San Diego Canyon has a high concentration of calcium and bicarbonate, but it also contains unexpected proportions of sodium and chloride. (Woodard-USGS)
W76-03393

CHEMICAL QUALITY OF GROUND WATER IN THE NORTHERN PART OF THE ALBUQUERQUE-BELEN BASIN, BERNALILLO AND SANDOVAL COUNTIES, NEW MEXICO,
Geological Survey, Albuquerque, N. Mex.
For primary bibliographic entry see Field 5B.
W76-03394

MAP SHOWING GROUND-WATER CONDITIONS IN THE WATERMAN WASH AREA, MARICOPA AND PINAL COUNTIES, ARIZONA--1975,
Geological Survey, Phoenix, Ariz.
For primary bibliographic entry see Field 7C.
W76-03399

INDEX OF SURFACE WATER QUALITY RECORDS TO SEPTEMBER 30, 1973, SOUTHEAST ALASKA,
Geological Survey, Anchorage, Alaska.
For primary bibliographic entry see Field 7C.
W76-03400

WATER RESOURCES OF WEST-CENTRAL MISSOURI,
Geological Survey, Rollo, Mo.
For primary bibliographic entry see Field 7C.
W76-03401

WATER QUALITY, FOUNTAIN AND JIMMY CAMP VALLEYS, COLORADO, 1973,
Geological Survey, Denver, Colo.
For primary bibliographic entry see Field 5B.
W76-03404

THE CHANNELS AND WATERS OF THE UPPER SALMON RIVER AREA, IDAHO,
Geological Survey, Boise, Idaho.
For primary bibliographic entry see Field 2E.
W76-03405

HYDROLOGIC DATA FOR URBAN STUDIES IN THE SAN ANTONIO, TEXAS METROPOLITAN AREA, 1973,
Geological Survey, Austin, Tex.
For primary bibliographic entry see Field 7C.
W76-03406

COMPLEXATION SIDE REACTIONS INVOLVING TRACE METALS IN NATURAL WATER SYSTEMS,
California Univ., Davis. Div. of Environmental Studies.
J. F. Elder.
Limnology and Oceanography, Vol 20, No 1, p 96-102, January, 1975. 3 fig, 2 tab, 13 ref.

Descriptors: *Heavy metas, *Pollutants, *Trace elements, Chemistry, *Speciation, Hydrogen ion concentration, Anions, Chemical reactions, Chemical properties, Iron, Cadmium, Copper, Zinc, Solubility.
Identifiers: *Complexation, *Side reactions, Stability constants, Competing reactions, Anionic concentration, Polynuclear complexation, Ligands.

Descriptions of trace metal speciation in natural freshwater systems are facilitated by the use of side reaction coefficients and conditional stability constants which permit simultaneous consideration of competing complexation reactions. Some specific descriptions are presented which illustrate the extreme dependence of speciation on pH and anionic concentrations. At low pH, hydroxide complexation is likely to be overshadowed by complexation by other anions. At high pH, polynuclear complexation becomes important. Graphs are included of the compuflexation of iron (III) and cadmium(II) by hydroxide, citrate, and pyrophosphate, expressed as the log of the side reaction coefficients as a function of total ligand concentration. (Davis-Vanderbilt)
W76-03411

FE-MN OXIDE COATINGS IN STREAM SEDIMENT GEOCHEMICAL SURVEYS,
Georgia Univ., Athens. Dept. of Geology.
For primary bibliographic entry see Field 5B.
W76-03412

COMBINED DAILY CLIMATIC DATA AND DILUTE SOLUTION CHEMISTRY IN STUDIES OF SOIL PROFILE FORMATION,
For primary bibliographic entry see Field 2G.
W76-03450

2L. Estuaries

IMPACT OF KRAFT PULP-MILL EFFLUENTS ON ESTUARINE AND COASTAL FISHES IN APALACHEE BAY, FLORIDA, USA,
Florida State Univ., Tallahassee. Dept. of Biological Science.
For primary bibliographic entry see Field 5C.
W76-03018

DIVERSITY AND OVERLAP AS MEASURES OF ENVIRONMENTAL QUALITY,
Woods Hole Oceanographic Institution, Mass.
For primary bibliographic entry see Field 6G.
W76-03024

SALINITY TOLERANCE OF THE TIDEPOOL SHRIMP PALAEMON RITTERI HOLMES,
Pennsylvania State Univ., Wilkes-Barre.
For primary bibliographic entry see Field 5C.
W76-03040

EFFECT OF SOUTH LOUISIANA CRUDE OIL AND NO. 2 FUEL OIL ON GROWTH OF HETEROTROPHIC MICROORGANISMS, INCLUDING PROTEOLYTIC, LIPOLYTIC, CHITINOLYTIC AND CELLULOLYTIC BACTERIA,
Maryland Univ., College Park. Dept. of Microbiology.
For primary bibliographic entry see Field 5C.
W76-03054

A STUDY OF THE INTERTIDAL MACROFAUNA AROUND THE BP REFINERY (KENT) LIMITED,
City of London Polytechnic (England). Dept. of Biological Sciences; and Sir John Cass Coll., London (England). School of Science and Technology.
For primary bibliographic entry see Field 5B.
W76-03055

ECONOMIC EFFECTS OF LAND SUBSIDENCE DUE TO EXCESSIVE GROUNDWATER WITHDRAWAL IN THE TEXAS GULF COAST AREA,
Texas A and M Univ., College Station. Water Resources Inst.
For primary bibliographic entry see Field 4B.
W76-03099

SEASONAL CHARACTERISTICS OF WATER MASSES IN MUIR INLET, A FJORD WITH TIDEWATER GLACIERS,
Alaska Univ., College. Inst. of Marine Science.
J. B. Matthews, and A. V. Quinlan.
Journal of the Fisheries Research Board of Canada, Vol 32, No 10, p 1693-1703, October 1975. 6 fig, 24 ref.

Descriptors: *Fjords, *Salinity, *Dissolved oxygen, *Glaciers, *Alaska, *Arctic, Density, Seasonal, Temperature, Water temperature, Runoff, Snowmelt, Melt water, Ablation, Melting, Coasts, Oceanography, Inlets(Waterways), Bays, Tides, Water circulation, Cold regions.
Identifiers: *Muir Inlet (Alaska).

The presence of two distinct seasonal water masses with transitions between them has been revealed in Muir Inlet, a fjord with tidewater glaciers in southeast Alaska. In spring a homogeneous water mass was found in which over 70% of the water fell into the ranges 31.0-31.2 parts per thousand salinity and 3.0-3.5 C. Heterogeneous water masses were found in summer and fall. The transition from the homogeneous to the heterogeneous water mass was explained on the basis of an entrainment mechanism during the summer high runoff period. It was suggested that the momogeneous spring condition derives from the intrusion of water from outside the fjord over the entrance sill which continues into early summer. This water exchange is driven primarily by tidal energy and depends upon denser water being available outside the sill during fall and spring. The differences between inlets with and without tidewater glaciers result from the melting of glacial ice in contact with warm, saline water

masses. The melting of glacial ice appeared to continue at all seasons in Muir Inlet. The dissolved oxygen content confirmed the almost continuous renewal, showing only relatively small seasonal variations. (Sims-ISWS)
W76-03112

EFFECTS OF STRUCTURES ON IRREGULAR WAVES COMPARED TO REGULAR WAVES,
Laval Univ., Quebec. Dept. of Civil Engineering.
For primary bibliographic entry see Field 8B.
W76-03119

WAVES OF MAXIMUM HEIGHT ON UNIFORM CURRENTS,
Delaware Univ., Newark. Coll. of Marine Studies; and Deleware Univ., Newark. Dept. of Civil Engineering.
For primary bibliographic entry see Field 8B.
W76-03120

SPARTINA REVEGETATION ON DREDGE SPOIL IN SE MARSHES,
Skidaway Inst. of Oceanography, Savannah, Ga.
For primary bibliographic entry see Field 5G.
W76-03121

SHORELINE CHANGES BETWEEN SABINE PASS AND BOLIVAR ROADS, AN ANALYSIS OF HISTORICAL CHANGES OF THE TEXAS GULF SHORELINE,
Texas Univ., Austin. Bureau of Economic Geology.
R. A. Morton.
Geological Circular 75-6, 1975. 43 p, 11 fig, 1 tab, 160 ref, 3 append.

Descriptors: *Shores, *Gulf coastal plain, *Erosion, *Geomorphology, *History, *Texas, Sea level, Sediment distribution, Storms, Hurricanes, Vegetation effects.
Identifiers: *Sabine Pass(Tex), *Natural processes.

Historical monitoring between Sabine Pass and Bolivar Roads recorded the nature and magnitude of changes in position of the shoreline and vegetation line and provided insight into the factors affecting those changes. Long-term trend or direction of shoreline changes averaged over the 92-year time period of this study indicated that net accretion was 2225 feet at Sabine Pass. Net erosion dominated the shoreline from the preceding segment to approximately 3 miles east of Crystal Beach. Net erosion for this segment over the 92-year time interval averaged 775 feet or 8.4 feet per year. Major and minor factors affecting shoreline changes included: (1) climate, (2) storm frequency and intensity, (3) local and eustatic sea-level conditions, (4) sediment budget, and (5) human activities. Studies indicated that changes in shoreline and vegetation line between Sabine Pass and Bolivar Roads were largely the result of natural processes, perhaps expedited by man's activities. (Bhowmik-ISWS)
W76-03133

A PROXIMATE BIOLOGICAL SURVEY OF SAND DIEGO BAY, CALIFORNIA,
Naval Undersea Center, San Diego, Calif.
For primary bibliographic entry see Field 5C.
W76-03170

CIRCULATIONS AND DENSITY DISTRIBUTIONS IN A DEEP, STRONGLY STRATIFIED, TWO-LAYER ESTUARY,
Johns Hopkins Univ., Baltimore, Md. Dept. of Mechanics and Materials Sciences; and Johns Hopkins Univ., Baltimore, Md. Dept. of Earth and Planetary Sciences.
R. R. Long.
Available from NTIS, Springfield, Va 22161 as AD-A006 737, $3.50 in paper copy, $2.25 in microfiche. Office of Naval Research Technical Report No. 7, (Series C), February, 1975. 24 p, 5 fig, 16 ref.

Descriptors: *Bodies of water, *Estuaries, *Model studies, *Distribution, *Mixing, *Stratification, Subcritical flow, Supercritical flow, Turbulence, Encroachment.

A theoretical model of statistically steady flow in a strongly stratified estuary is presented. A holocline is assumed to be present and the lower layer is taken to be deep and non-turbulent. The outflowing upper fluid mixes with the salty lower fluid and the flux of the brackish water increases with distance from the head of the estuary. The mixing is assumed to be similar to that in laboratory models of mixing across density interfaces. Two equations of mass conservation are used, one for the steady-state mass flux across a vertical section from top to bottom of the channel and one for the mass flux into a section of the upper fluid. A buoyancy conservation equation is used for the buoyancy flux across a vertical section. A final equation is obtained by integrating the horizontal equation of motion across a section of the upper fluid. The flow in this layer is assumed to be opposed by a frictional force proportional to the square of the velocity averaged over the layer. The pressure-gradient force arising from the slope of the free surface is solved for in terms of the thickness of the upper layer, the buoyancy difference across the interface, the slope of the interface and the horizontal density gradient in the upper layer. The derivation shows that the horizontal pressure-gradient force vanishes in the lower layer. The mathematical problem reduces to two ordinary differential equations for the flux in the upper layer and the thickness of the layer. The complete solution is obtained as a function of the fresh-water influx per unit width, the rms turbulent velocity, the estuary length and the buoyancy of sea water. (Sinha-OEIS)
W76-03172

LONG-TERM VARIABILITY IN THE STRUCTURE OF SUBTIDAL BENTHIC COMMUNITIES IN PUGET SOUND, WASHINGTON, USA,
Nordic Council for Marine Biology, Biomsterdalen (Norway). Espegrend Biological Station.
For primary bibliographic entry see Field 5C.
W76-03173

EFFECTS OF OCEAN DISPOSAL ACTIVITIES ON MID-CONTINENTAL SHELF ENVIRONMENT OFF DELAWARE AND MARYLAND,
Environmental Protection Agency, Annapolis, Md. Annapolis Field Office.
For primary bibliographic entry see Field 5C.
W76-03175

PHYSICAL, CHEMICAL, AND BIOLOGICAL CHARACTERISTICS OF NEARSHORE ZONE OF SAND KEY, FLORIDA, PRIOR TO BEACH RESTORATION. VOLUME I,
National Marine Fisheries Service, Panama City, Fla. Gulf Coastal Fisheries Center.
C. H. Saloman.
Available from NTIS, Springfield, Va 22161 as AD-A007 422, $16.25 in paper copy, $2.25 in microfiche. Department of the Army, Fort Belvoir, VA, Coastal Engineering Research Center (CERRE-EC) Report, Vol 1, June 1974. 699 p, 145 fig, 114 tab, 18 ref, appends.

Descriptors: *Beach erosion, *Surveys, Sampling, Environment, Environmental effects, Aquatic environment, Coasts, Coastal engineering, Dredging, *Florida, Data collections, Bibliographies.
Identifiers: *Nearshore zone, *Sand Key(FL), Beach restoration.

Continuing erosion along the gulf side of Sand Key, Florida, has reduced desirable beach areas and rendered shore installations vulnerable to storm damage. The U.S. Army Corps of Engineers plans to restore the damaged beaches and, as necessary, to periodically nourish them to control further erosion. In order to assess the ecological effects of the proposed hydraulic dredging, some of the major physical, chemical, and biological characteristics of the nearshore zone off Sand Key prior to restoration are defined. Also included are results of a supplemental study on the effects of hydraulic dredging for emergency restoration of Sunset Beach on Treasure Island, Florida and a bibliography of published and unpublished information pertinent to the physical, chemical, and biological characteristics of the nearshore zone. (Sinha-OEIS)
W76-03177

HYDROLOGY AND CIRCULATION PATTERNS IN THE VICINITY OF OREGON INLET AND ROANOKE ISLAND, NORTH CAROLINA,
North Carolina State Univ., Raleigh. Dept. of Geosciences.
For primary bibliographic entry see Field 2E.
W76-03178

DAILY AND WEEKLY UPWELLING INDICES, WEST COAST OF NORTH AMERICA, 1967-73.
National Marine Fisheries Service, Monterey, Calif. Pacific Environmental Group.
Available from Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402. NOAA Technical Report NMFS SSRF-693, August 1975. 114 p, 3 fig, 6 tab, 8 ref, append.

Descriptors: Upwelling, *Circulation, Oceans, Coasts, *Currents(Water), *Ocean currents, Water circulation, North America, Stress, Atmospheric pressure, Spatial distribution.
Identifiers: *Upwelling indices, *Coastal upwelling, *Ekman transport, Ekman layer, *Sea surface stress, Offshore transport, Fishery resources, Stress calculation, Upwelling plots, Upwelling tabulations.

Daily and weekly indices of intensity of large-scale wind-induced coastal upwelling at selected locations along the west coast of North America are presented for the 7-yr period, 1967-73. The indices are based on 6-hourly computations of the offshore component of Ekman transport using the synoptic surface atmospheric pressure analyses produced by the Fleet Numerical Weather Central to estimate the sea surface stress. The magnitude of offshore transport is considered an indication of resultant upwelling through the bottom of the Ekman layer. A spatial distortion in absolute magnitude results in noncomparability of numerical values between different locations. (NOAA)
W76-03179

STORM TIDE FREQUENCY ANALYSIS FOR THE COAST OF NORTH CAROLINA, NORTH OF CAPE LOOKOUT,
National Weather Service, Silver Spring, Md.
For primary bibliographic entry see Field 2B.
W76-03181

WATER MOVEMENT WITHIN THE APEX OF THE NEW YORK BIGHT DURING SUMMER AND FALL OF 1973,
National Oceanic and Atmospheric Administration, Miami, Fla. Physical Oceanography Lab.
R. L. Charnell, and D. A. Mayer.
NOAA Technical Memorandum ERL MESA-3, April 1975. 29 p, 18 fig, 2 tab, 5 ref.

Descriptors: *Currents(Water), *Water circulation, *Ocean circulation, *Current meters, Tides, Winds, Flow, Water quality, Flow measurement, New York.

Identifiers: *New York Bight, *Current meter data, Environmental conditions, Physical oceanography.

An investigation of the water movement within the New York Bight Apex was made during the summer and fall of 1973. Observations from this study produced a fairly consistent picture of general clockwise circulation for the mean and low frequency (periods greater than 40 hr) current motions. Additionally, the effects of stratification on the vertical structure of the flow showed the difference between the summer and late fall flow regimes. There also appeared to be, for low frequencies, excellent spatial coherence between stations in the apex area and a fairly strong relation between meteorological forcing and current motions; currents tended to lag wind by up to 18 hr. (NOAA)
W76-03185

ANNUAL SUMMARY OF RESEARCH RESULTS FOR FISCAL YEAR 1974, MESA NEW YORK BIGHT PROJECT.
National Oceanic and Atmospheric Administration, Boulder, Colo. Marine Ecosystems Analysis Program Office.
NOAA Technical Memorandum ERL MESA-2, September 1975. 193 p, 106 fig, 2 tab, 120 ref.

Descriptors: *Project planning, *Projects, Geological surveys, Oceanography, Marine geology, Sewage sludge, Water pollution, Water quality, *Sewage disposal, Coasts, Coastal structures, New York, Waste disposal.
Identifiers: *New York Bight, *Ocean dumping, Offshore facilities.

This is the first annual summary of research results of the National Oceanic an Atmospheric Administration's (NOAA) Marine EcoSystems Analysis (MESA) Program New York Bight Project. It summarizes the scientific technical and engineering accomplishments of the Project during fiscal year 1974 (FY74), the last quarter of FY73, not summarized previously. Results pertinent to the pressing issue of ocean disposal of sewage sludge in the New York Bight, accomplished from the last quarter of FY73, through the first quarter of FY75 are summarized in a separate report entitled 'Ocean Dumping in the New York Bight.'. Research results are presented in a classical discipline orientation; physical, chemical, biological and geological research efforts are discussed in some detail, including significant data and results. (NOAA)
W76-03186

NEW YORK BIGHT PROJECT, WATER COLUMN SAMPLING CRUISES NO 1-5 OF THE NOAA SHIP FERREL, AUGUST-NOVEMBER 1973,
National Oceanic and Atmospheric Administration, Boulder, Colo. Marine Ecosystems Analysis Program Office.
For primary bibliographic entry see Field 7C.
W76-03187

AN AVERAGE, LONG-PERIOD, SEA-LEVEL SERIES FOR THE UNITED STATES,
National Ocean Survey, Rockville, Md.
S. D. Hicks, and J. E. Crosby.
Available from the National Technical Information Service, Springfield, Va 22161. NOAA Technical Memorandum NOS 15, September 1975. 6 p, 1 fig, 10 ref.

Descriptors: *Sea level, *Water levels, *Tides, Elevation, Tidal effects, Tidal waters, Water measurement, Water level recorders, Meteorological data, Oceanography, United States.
Identifiers: *Sea level series, *Sea level management, *Water elevation, *Tide gage measurements, Meteorological oscillations, Oceanographic oscillations, Water level management, Tide measurements, Tide stations.

An average, long-period, sea-level series for the United States (except Alaska and Hawaii), from which a representative curve and a single-value rate were derived, is presented for the first time. The series was obtained by averaging common-length, uninterrupted, sea-level series obtained from tide gage measurements. The averaging was by coastal area. The curve, with amplitudes of its meteorological and oceanographic oscillations of periods less than 5 1/3 years attenuated more than 90%, shows the relative, apparent secular trend and its changes for the United States as a whole. During the 34-year period, 1940 through 1973, sea level rose along the coasts of the United States at the average rate of 1.5mm (0.005 ft) per year. (NOAA)
W76-03188

ESTUARY TO BE STUDIED AS D.C. WATER SOURCE,
Illinois State Univ., Normal. Coll. of Applied Science and Technology.
For primary bibliographic entry see Field 5F.
W76-03208

A STRATEGY FOR MANAGEMENT OF MARINE AND LAKE SYSTEMS WITHIN THE NATIONAL PARK SYSTEM.
National Park Service, Washington, D.C. Office of Natural Science.
Dune Stabilization Study, Natural Science Report No. 6, 1973, 40 p.

Descriptors: *Shore protection, *Beaches, *Dunes, National lakeshores, National seashores, Stabilization, Erosion, Barriers, Balance of nature, Deposition(Sediments), Sand bars, Vegetation establishment, Tidal marshes, Reefs, Management, *Comprehensive planning.
Identifiers: Barrier islands.

The approach followed by the National Park Service for conservation of lakeshores and seashores under their jurisdiction is based on understanding the nature of the shoreline material and its behavior under natural and anthropogenic stress. Management strategies are based on the concept that stable features are in conflict with nature; in areas stressing natural landscapes, management strategy must be tolerant of both short and long term change. Locations of natural historic significance may require stabilization of short-term changes, however, long-term trends will require continuing corrective measures at considerable cost. A sound management strategy includes acquisition and control of lands and waters adjacent to the coastal intefaces; where acquisition is not feasible efforts should be directed toward encouragement of wise land and water use policies. Management decisions affecting primary interfaces are at best short-term or temporary while those affecting more mature ecosystems have a long life expectancy. Restoration projects should rely on native materials and the forms enhanced should be consistent with naturally occurring forms. Master plans for the new marine park areas and revised plans for older areas should include analyses of physical interfaces and ecotones, and decisions should be based on these boundaries and the surfaces between. (Auen-Wisconsin).
W76-03296

VARIATIONS IN THE HYDROCHEMICAL REGIME OF THE COASTAL WATERS IN WINTER INFLUENCED BY MACROPHYTES, (IN RUSSIAN),
Murmanskii Morskoi Biologicheskii Institut (USSR).
For primary bibliographic entry see Field 5C.
W76-03305

APPLICATION OF THE STAINTON SYRINGE METHOD TO THE ANALYSIS OF MERCURY IN NATURAL WATERS,
Fisheries and Marine Service, West Vancouver (Brittish Columbia). Pacific Environmental Inst.
For primary bibliographic entry see Field 5A.
W76-03313

THE USE OF A DIGITAL MODEL IN THE MANAGEMENT OF THE CHALK AQUIFER IN THE SOUTH DOWNS, ENGLAND,
Department of the Environment, Reading (England). Central Water Planning Unit.
For primary bibliographic entry see Field 4B.
W76-03356

A NUMERICAL MODEL OF THE CIRCULATION IN CIENFUEGOS BAY, CUBA,
Kiel Univ. (West Germany). Institut Fuer Meereskunde.
M. Tomczak, Jr., and C. Garcia Diaz.
Estuarine and Coastal Marine Science, Vol 3, No 4, p 391-412, October 1975. 14 fig, 18 ref.

Descriptors: *Circulation, *Estuaries, *Hydrodynamics, *Rivers, *Model studies, Fisheries, Numerical analysis, *Path of pollutants, Water temperature, Salinity, Diffusion, Bays, Water circulation, Wet seasons, Dry seasons.
Identifiers: *Cienfuegos Bay(Cuba) *Carribean Sea, Hydrodynamic numerical methods, Two-layered estuary.

The circulation in Cienfuegos Bay, a very shallow (less than 30 m depth) nearly enclosed bay of estuarine characteristics, was calculated, integrating the hydrodynamic equations numerically and including frictional and diffusive terms. In order to reproduce the observed shallow pycnocline and the surface density distribution, the coefficient of virtual diffusion has to be inversely proportional to the square of the density gradient. Transitory internal periodic motion was damped out by applying relatively strong bottom friction. The resulting density distribution compared well with observations. The circulation was modeled both for wet and dry season. River runoff governs the circulation during the wet season. In the northern part of the bay the surface layer of outgoing fresh water is very shallow (2 m or less) but deepens as the outlet into the Carribean Sea is approached. The southern part of the bay shows only a very little motion. The area around the industrial town of Cienfuegos is nearly stagnant throughout the year, especially during the wet season. (Singh-ISWS)
W76-03374

A NOTE ON AQUADRATIC FRICTION IN THE PRESENCE OF TIDES,
John Hopkins Univ., Baltimore, Md. Cheaspeake Bay Inst.
J. R. Hunter.
Estuarine and Coastal Marine Science, Vol 3, No 4, p 473-475, October 1975. 2 ref.

Descriptors: *Tides, *Friction, *Boundary layers, *Ocean currents, *Velocity, Mathematical studies, Estuaries, Hydraulics, Tidal streams, Ocean circulation.
Identifiers: *Quadratic friction, Scalar friction, Two-dimensional models.

It has long been realized that time averaging a quadratic friction term, in the presence of strong tidal currents, gives a frictional force that is linearly dependent on the mean current. An analysis showed that the friction coefficient is twice as large in a direction parallel to the tidal current as in a direction perpendicular to the tidal current. This implied an increased tendency for mean currents to flow at right angles to the tidal stream. Many two-dimensional models utilize a scalar friction coefficient to account for bottom friction. The best estimate for that coefficient is probably the average of the parallel and perpendicular values. (Singh-ISWS)

W76-03375

A THEORETICAL MODEL OF THE FLOW IN THE MOUTH OF SPENCER GULF, SOUTH AUSTRALIA,
Flinders Inst. of Atmospheric and Marine Sciences, (Australia).
J. A. T. Bye, and J. A. Witehead, Jr.
Estuarine and Coastal Marine Science, Vol 3, No 4, p 477-481, October 1975. 3 fig, 3 ref. NSF GA-35447.

Descriptors: *Gulfs, *Estuaries, *Flow, *Circulation, *Australia, *Salinity, Saline water systems, Density currents, Oceanography, Model studies, Theoretical analysis, Currents(Water), Distribution patterns.
Identifiers: *Circulation pattern, *Spencer Gulf(South Australia), Theoreticl model, Surface currents, Bottom currents.

The salinity distribution in Spencer Gulf, South Australia, indicates an inflow of low salinity water on the west side of the gulf, modification of the water mass at the northern end, and an outflow of water of increased salinity on the east side. This system appears to be an excellent example of a theoretical model recently proposed for flushing controlled by a buoyancy-inertial current. (Lee-ISWS)
W76-03376

DESCRIPTION OF SEASONAL BEACH CHANGES USING EMPIRICAL EIGENFUNCTIONS,
Scripps Institution of Oceanography, San Diego, Calif.
C. D. Winant, D. L. Inman, and C. E. Nordstrom.
Journal of Geophysical Research, Vol 80, No 15, p 1979-1986, May 20, 1975. 11 fig, 1 tab, 13 ref.

Descriptors: *Beaches, *Beach erosion, *Profiles, *Terracing, *California, Waves(Water), Littoral drift, Berms, Statistical methods, Tides, Geomorphology, Seasonal.
Identifiers: *Eigenfunctions, *Torrey Pines Beach(Calif), Bars.

A 2-yr set of profile data from Torrey Pines Beach, California, measured at monthly intervals has been statistically analyzed by using empirical eigenfunctions. The analysis separated the temporal and spatial dependence of the data, this separation permitting beach changes to be described objectively by a linear combination of corresponding time and space functions. Most of the variation in profile configuration can be accounted for by three eigenfunctions corresponding to the three largest eigenvalues. The largest eigenvalue corresponds to an eigenfunction called the 'mean beach function,' which represents an average profile. A second eigenfunction, the 'bar-berm function,' has a large maximum at the location of the summer berm and a minimum at the location of the winter bar, indicating its relation to the seasonal onshore-offshore movement of sand. The third eigenfunction, the 'terrace function,' has a maximum at a location of the low-tide terrace. Results of the study indicated that the eigenfunctions are useful in the analysis of beach profile data and provide objective insight into the nature of the variations of the profile configuration. (Bhowmik-ISWS)
W76-03377

THE EFFECT OF BOTTOM TOPOGRAPHY ON A STRATIFIED FLOW IN THE BETA PLANE,
Case Western Reserve Univ., Cleveland, Ohio. Dept. of Fluid, Thermal, and Aerospace Sciences.
For primary bibliographic entry see Field 2H.
W76-03378

SECOND-ORDER WAVE FORCE ON LARGE VERTICAL CYLINDER,
Chicago Bridge and Iron Company, Plainfield, Ill. Marine Research and Development.
For primary bibliographic entry see Field 8B.
W76-03381

SUMMARY, FINAL REPORT 1975, OREGON COASTAL CONSERVATION AND DEVELOPMENT COMMISSION.
(1975), 50 p.

Descriptors: *Coasts, *Oregon, *Interstate commissions, Publications, Management, Environmental effects, Economic impacts, Resource development.
Identifiers: Oregon Coastal Commission, Coastal zones, *Commission report, Management program, Policy developments, Environmental impacts, Economic impacts, Resource management, *Coastal Zone Management.

This report is a synopsis of the Oregon Coastal Conservation and Development Commission's final report for 1975. It includes a brief description of the Policy Development Process used by the Commission; a listing of the goal, objectives, policies, necessary and recommended actions of the management program; and a brief description of the management program support processes. (NOAA)
W76-03418

AESTHETIC RESOURCES OF THE COASTAL ZONE.
Mann (Roy) Associates, Inc., Cambridge, Mass.
Office of Coastal Zone Management, July 1975, 208 p.

Descriptors: *Coasts, *Aesthetics, Recreation, Scenery, Community development, Shores, Land use, Land resources, Water resources, Resources development.
Identifiers: Aesthetic resources, Coastal zone, *Coastal zone management, *Coastal resources, Water use, Shorelines, Resource planning, Resource management.

The purpose of this handbook is to guide state coastal zone management agencies in the preparation of planning elements for the delineation and management of coastal aesthetic resources. The handbook presents background information, definitions, criteria, procedures for aesthetic resource identification and documentation. Procedures for inventorying and mapping are discussed, as are methods and criteria for defining boundaries of geographic areas of particular aesthetic concern and outstanding aesthetic resource areas. Relative merits of major generic methodologies of coastal landscape assessment are identified. Criteria are developed for determining those aesthetic resources which are sensitive to development, and for identifying features of land and water uses and structures which are typically incompatible with specified aesthetic resources. Finally, means for implementation of state aesthetic resource planning recommendations are identified, including management tools at state, regional, and local jurisdiction levels, and methods by which the public can participate in the aesthetic resource planning process. (NOAA)
W76-03419

THE EFFECTS OF FRESHWATER INFLOWS ON HYDROLOGICAL AND BIOLOGICAL PARAMETERS IN THE SAN ANTONIO BAY SYSTEM, TEXAS,
Texas Parks and Wildlife Dept., Austin, Coastal Fisheries Branch.
R. Childress, E. Bradley, E. Hagen, and S. Williamson.
NOAA Project No 2 - 160-R, August 1975, 210 p.

Descriptors: Freshwater, *Water quality, *River flow, *Inflow, Rivers, Fresh water fish, Sampling, Hydrologic data, Biological properties, Water sources, Rivers, Channel flow, Currents(Water), Meteorological data, Aerial photography, *Texas.
Identifiers: *Freshwater inflows, *River inflows, Hydrological parameters, Biological parameters, *San Antonio Bay system(Tex), Meteorological parameters, Fish landings, Shellfish landings, Estuarine biota.

Between September 1971 and May 1974, semi-monthly samples of biologic, water quality, and meteorologic parameters were taken at various stations in the San Antonio Bay system of Texas. Hydrographic parameters concerning current movements were measured at selected intervals. The biological data and historical commercial fish and shellfish landings statistics were subjected to computerized analysis for possible correlations with simple and cumulative lag river inflow to the estuary and various hydrologic parameters. These analyses were performed in an effort to determine the importance of freshwater inflows, their effect on estuarine biota, and the quantity and quality of fresh water required by the system. Maps based on aerial photography were used to measure the dimensions of physical features within the system. Riverflow was the major source of fresh water and thereby exerted the most influence on the hydrologic parameters of the system. Rainfall supplied much less water than riverflow and was always exceeded by evaporation when averaged annually. Riverflow was also the main source of nutrients to the bay supplying an estimated daily average of 32 metric tons of phosphorus and 26 metric tons of nitrogen. (NOAA)
W76-03420

WAVE TRANSFORMATIONS OVER A SLOPING BOTTOM AND OVER A THREE-DIMENSIONAL SHOAL,
Hawaii Univ., Honolulu. Dept. of Ocean Engineering.
J. R. Walker.
PhD Dissertation, May 1974, 156 p. Miscellaneous Rept No 11, U Hawaii-Look Lab-75-11, UNIHI-Sea Grant-CR-75-03.

Descriptors: *Waves(Water), *Shoals, *Refraction(Water waves), Ocean waves, Shallow water, Currents(Water), Fluctuations, Water circulation, Wavelengths, Water levels.
Identifiers: *Wave transformations, *Three-dimensional shoals, *Wave height, *Wave breaking, *Wave refraction, Wave-height growth, Wave-height decay, Phase velocities, Refraction patterns, Refraction analysis, Water waves.

This dissertation is concerned with the transformation of waves over a sloping bottom and over a three-dimensional shoal. The primary objective of this study was to ascertain the effect of wave height and wave breaking on wave refraction over a three-dimensional shoal. A hydraulic model was constructed to study the phenomena. The model study was conducted in two phases. First, wave transformations over a constant bottom slope propagating from intermediate water depths through the breaking zone in shallow water depths were studied. In this series of tests, the wave-height growth, decay, and phase velocities were studied. The second series of tests was conducted to ascertain the refraction patterns over a three-dimensional shoal. Measured refraction patterns and coefficients were compared with refraction patterns predicted by conventational refraction analysis techniques which use Airy wave theory. The refraction patterns over the three-dimensional shoal were observed to be a function of wave height and wave breaking. The waves with small heights followed the refraction patterns predicted by conventional refraction techniques well. Results showed that conventional refraction analysis is a function of finite height and wave breaking. (NOAA)
W76-03421

HEAT INFLUENCES IN ESTUARINE ECOSYSTEMS,
North Carolina State Univ., Raleigh. Dept. of Zoology.
For primary bibliographic entry see Field 5C.
W76-03489

3. WATER SUPPLY AUGMENTATION AND CONSERVATION

3A. Saline Water Conversion

CONTINUED STUDIES ON THE USE OF A MIXED CHROMATE-PHOSPHATE INHIBITOR IN DESALINATION SERVICE: PART TWO,
Dow Chemical Co., Midland, Mich.
B. D. Oakes, S. R. Wilson, and C. F. Schrieber.
Available from the National Technical Information Service, Springfield, Va 22161 as PB-248 976, $5.00 in paper copy, $2.25 in microfiche. OWRT/S--1976/8, June 1975, 84 p, 23 fig, 15 tab. OSW-14-30-3111.

Descriptors: *Desalination, *Distillation, *Sea water, *Corrosion, *Water chemistry, *Inhibitors, Copper alloys, Steel alloys.
Identifiers: Materials of construction.

A chromate-phosphate corrosion inhibitor has been developed and tested for protection of metal surfaces in desalination plants. Continuous addition of 2.5 to 5.0 ppm of the inhibitor (9 parts phosphate to 1 part chromate) effectively controls corrosion of structural, stainless, and low alloy steels and copper alloys. The protection is achieved at dissolved oxygen levels of near zero to 500 parts per billion. Two to ten-fold reduction of corrosion rate on steels, depending somewhat on temperature, pH, velocity and dissolved oxygen is attainable. A greater reduction is possible with copper alloys. This inhibitor is not suitable for aluminum alloys. Use of this inhibitor is recommended for new plants of all steel construction as well as for use in existing plants that are experiencing excessive steel and copper alloy corrosion. Techniques are available to allow recycling of chromate with no ecological damage to environment. Cost of inhibitor addition is 3.8 cents per thousand gallons of potable water. (OWRT)
W76-03143

DEVELOPMENT, FABRICATION AND TESTING OF A PPB COPPER ANALYZER,
Dow Chemical Co., Midland, Mich.
B. P. Webb.
Available from the National Technical Information Service, Springfield, Va 22161 as PB-248 688, $4.00 in paper copy, $2.25 in microfiche. OWRT/S--1976/5, March 1973, 35 p, 13 fig, 1 tab. OSW 14-30-3035.

Descriptors: *Desalination, *Distillation, *Sea water, *Corrosion, *Copper alloys, *Water chemistry, Water analysis, Color reactions, Spectrophotometry.
Identifiers: Ion complexing, Particulate copper.

A parts per billion (ppb) total copper analyzer has been developed, fabricated and tested. Samples from desalination plant waste streams contain copper in three distinct forms, ionic, complexed, and particulate, all of which must be converted to a common form for colormetric analysis of 'total' copper. Acid conversion is the most common method with hydrofluoric being preferred over hydrochloric or nitric. The addition of colorimetric reagent results in a colored complex, the amount of color being a function of copper concentration. The amount of color as determined spectrophotometrically is related to the 'total' copper concentration in the sample stream. Field testing of the completed analyzer under actual and experimental desalting plant conditions has shown it to be a highly reliable and accurate instrument when compared to actual laboratory copper analyses by conventional methods. (OWRT)
W76-03144

SEA WATER CORROSION TEST PROGRAM: PART THREE,
Dow Chemical Co., Midland, Mich.
C. F. Schrieber, T. D. Boyce, A. L. Whitted, S. E. Hill, and B. P. Webb.
Available from the National Technical Information Service, Springfield, Va 22161 as PB-248 671, $7.50 in paper copy, $2.25 in microfiche. OWRT/S--1976/10, January 1973, 179 p, 83 fig, 6 tab, 16 ref. OWS 14-01-0001-2150.

Descriptors: *Desalination, *Distillation, *Sea water, *Corrosion, *Aluminum alloys, *Copper alloys, Steel, Metals, Deaeration, Oxidation.
Identifiers: *Dissolved oxygen concentration.

This report discusses the roles of oxygen and temperature as they influence corrosion behavior of an alloy system. At low or intermediate dissolved oxygen (DO) concentrations (75 ppb) sea water temperature through 250 F had little effect on the behavior of the copper alloy family. However, at 500 ppb DO a temperature increase of 70 F (from 180 to 250 F) more than doubled the corrosion rates of copper alloys and mild steel. The aluminum alloys as a family were not strongly influenced by temperature increases in this range. It was noted that initial exposure of aluminum to low levels of DO concentration tended to reduce corrosion by forming a protective oxide film that serves as an effective barrier to further corrosive attack. 70-30 CuNi was found to be especially resistant to high DO concentrations followed by 90-10 CuNi and by aluminum brass. 1010 mild steel registered poorly on a comparative basis. (See also W70-01397, W70-02691, and W71-07975). (OWRT)
W76-03145

SEA WATER CORROSION TEST PROGRAM: PART FOUR,
Dow Chemical Co., Midland, Mich.
C. F. Schrieber.
Available from the National Technical Information Service, Springfield, Va 22161 as PB-248 672, $8.00 in paper copy, $2.25 in microfiche. OWRT/S--1976/11, April 1975. 239 p, 105 fig, 30 tab, 7 ref. OSW 14-30-3111.

Descriptors: *Desalination, *Distillation, *Sea water, *Corrosion, *Pitting, Copper alloys, Aluminum alloys, *Electrochemistry, Steel, Deaeration, Oxidation, Metals.
Identifiers: *Crevice corrosion.

This report makes important contributions to existing electrochemical techniques to predict alloy pitting in saline waters. A galvanic series for alloys in hot sea water routinely used in desalination is developed. Among other subjects discussed are: Corrosion behavior of selected alloys in high temperature (290-320 F) softened sea water; effect of dissolved gases on alloy corrosion in the vapor and condensed vapor zones; corrosion behavior of alloys in quiescent sea water. The impingement resistance of AISI 1020 mild steel and type 316 stainless steel and the current density requirements for cathodic protection of steel in hot water are also considered. Appendices include procedures for analyses of dissolved oxygen and carbon dioxide in sea water as well as the determination of total alkalinity in sea water and decarbonated sea water. A special appendix treating of heat transfer and fouling resistance theory is included. (OWRT)
W76-03146

STUDY OF CROSSLINKED POLYMERS FOR DESALINATION,
Chemico Process Plants Co., El Monte, Calif. Envirogenics Systems.
R. W. Lawrence, and W. J. Schell.
Available from the National Technical Information Service, Springfield, Va 22161 as PB-236 934, $4.00 in paper copy, $2.25 in microfiche. Office of Saline Water, Report INT-OSW-RDPR-74-996, July 1974. 38 p, 9 tab, 7 fig, 14 ref. OWRT Contract 14-30-3190.

Descriptors: Desalination, *Demineralization, *Separation techniques, Water treatment, Adsorption, *Desalination processes, Solvation, Water purification, Feasibility studies, Waste water treatment, Diffusion.
Identifiers: Polymer solvation, *Crosslinked polymers, Diffusion coefficients, Water Sorption rates, Salt rejection, Water diffusivity, Polyether urethanes.

An investigation was conducted on the feasibility of desalination by sorption of water from a brine into a resin and recovery of desalinated water by desorption from the resin at an elevated temperature. The envisioned process consists of sorption into a column of resin beads, rinsing of the column to remove the brine, desorption at a higher temperature to produce desalinated water and repetition of the process. Crosslinked polyether urethanes were investigated and found to provide salt rejections up to 98% depending on the temperatures of sorption and desorption. The polyurethane offering the best desalination capability was prepared from an oxyethylene-oxypropylene copolyether diol, tolylene diisocyanate and trimethylolpropane. This resin had a water diffusion coeffient of 2 x 10-7 cm2/sec, comparable to that of cellulose acetate. With this coefficient and an estimate of the thermal diffusivity, and assuming a resin bead diameter of 0.6 mm, a cycle time of 43 min was calculated for the process between the temperatures of 21 and 31 C. Under these conditions, the daily productivity would be 118 gal per 100 lbs of resin. Calculations of the energy requirements showed that improvements in water productivity would be required to make the process competitive with reverse osmosis for the desalination of seawater. (OWRT)
W76-03147

HIGH TEMPERATURE ELECTRODIALYSIS - PHASE V,
Ionics, Inc., Watertown, Mass.
F. B. Leitz, M. A. Accomazzo, H. I. Viklund, and A. D. Jha.
Available from the National Technical Information Service, Springfield, Va 22161 as PB-234 184, $5.00 in paper copy, $2.25 in microfiche. Office of Saline Water Report INT-OSW-RDPR-74-985, June 1974. 75 p, 43 fig, 6 tab, 7 ref. OSW 14-30-3084.

Descriptors: *Desalination, *Seawater, *Brackish water, *Electrodialysis.
Identifiers: *Membrane conductivity, *Stack resistance, *Endurance tests, Thin membranes, Thin spacers, Membrane backing.

The overall objective of this program is the development of improved electrodialysis technology for water desalination. On previous contracts the effect of and means of obtaining two process improvements: high temperature operation and use of thinner components were investigated. This phase has specifically dealt with manufacture and shop testing of two stages each of which consisted of 130 cell pairs of the new components. Further refinements were made in the economic evaluation of such components for desalination of sea water. With reasonable assumptions of economic parameters, total desalination costs are estimated to be 16 to 24 cents per m3 (60 to 90 cents per 1000 gals). (OWRT)
W76-03148

DEVELOPMENT OF CTA HIGH FLUX LOW OPERATING PRESSURE R.O. MODULES,
Dow Chemical Co., Walnut Creek, Calif. Western Div. Research Labs.
E. A. McLain.

Available from the National Technical Information Service, Springfield, Va 22161 as PB-234 174, $4.50 in paper copy, $2.25 in microfiche. Report INT-OSW-RDPR-74-984, June 1974. 49 p, 23 fig, 8 tab, 5 ref. OSW 14-30-3054.

Descriptors: *Desalination, *Reverse osmosis, *Membranes, Hollow fiber, Cellulose triacetate, Brackish water, Waste water treatment.
Identifiers: *Module design, *Module construction.

High flux cellulose triacetate hollow fibers were developed for desalting brackish water at low operating pressure. Multi-filament yarns containing uniform hollow fibers in the size range 180 microns to 250 microns O.D. and 60 microns to 90 microns I.D. were produced at spinning speeds in the range of 50 to 100 feet per minute. Fibers having a flux of 3.0 GFD and a sodium chloride rejection of 85% at 150 psi on 2000 ppm NaCl feed were produced. The desirability of using standard PVC pipe for low pressure R.O. module cases was explored. A 30,000 GPD module design was made on the basis of test results. The module contains two cartridges within 14-1/2 inch diameter, filament wound, fiber glass reinforced plastic case. The flow mode through the two cartridges is radial double pass, the saline water flowing transversely outwardly across the fibers of one cartridge and inwardly across the fibers of the other. An operating pressure of 250 psi was selected. Productivity was rated on the basis of one year's compaction. A rejection of 85% is guaranteed when the module is operated at 50% water recovery from feed containing 2000 ppm NaCl. (OWRT)
W76-03149

ONE PASS SEAWATER DESALINATION HOLLOW FINE FIBERS,
Dow Chemical Co., Walnut Creek, Calif. Western Div. Research Labs.
T. E. Davis.
Available from the National Technical Information Service, Springfield, Va 22161 as PB-234 101, $4.00 in paper copy, $2.25 in microfiche. Office of Saline, Report INT-OSW-RDPR-74-983, June 1974. 40 p, 18 fig, 7 tab. OSW 14-30-3032.

Descriptors: *Desalination, *Reverse osmosis, *Membranes, Cellulose triacetate, Permeability, Sea water.
Identifiers: *Molecular weight variations, Compaction resistance.

The results of efforts to improve the performance characteristics of cellulose triacetate hollow fiber membranes suitable for the single pass desalination of seawater are reported. Effects of the modification of the spinning blend composition and processing variables upon the compaction and permeation of fibers developed under OSW Contract 14-30-2799 were investigated. The most encouraging development is a 30 to 40% increased water permeability without significant changes in salt rejection, compaction rate, or alteration of the fiber production process. This improvement was achieved by an increase of the average molecular weight of a polymeric plasticizer component, polyethylene glycol, used in the spinning blend. Three 8 inch reverse osmosis modules were fabricated and tested on both brackish and seawater. One module produced potable water from seawater at 25% product recovery for the 3,300 hours it was operated at the San Francisco Aquarium test site and the OSW Test Facility in San Diego. (OWRT)
W76-03150

IN SITU-FORMED CONDENSATION POLYMERS FOR REVERSE OSMOSIS: SECOND PHASE,
North Star Research Inst., Minneapolis, Minn.
J. E. Cadotte, C. V. Kopp, Jr., K. E. Cobian, and L. T. Rozelle.
Available from the National Technical Information Service, Springfield, Va 22161 as PB-234 198, $5.50 in paper copy, $2.25 in microfiche. Office of Saline Water, Report INT-OSW-RDPR-74-982, July 1974. 92 p, 21 tab, 18 fig, 29 ref. OSW 14-30-2883.

Descriptors: *Reverse osmosis, *Membranes, *Desalination, *Semipermeable membranes, Sea water, Permselective membranes, Thin films, Pressure, Separation techniques.
Identifiers: *Composition membranes, Ultrathin membranes, Interfacial polymerization, Porous polysulfone, In situ-formed membranes, Spiral wrap modules, Tubular modules, *NS-100 membrane composites, NS-200 membrane composites.

A new, highly promising membrane has been developed for single stage reverse osmosis seawater desalination. This membrane, designated NS-200, consists of furfuryl alcohol polymerized onto a microporous polysulfone support. This membrane has demonstrated very high salt rejections and water fluxes (an average of 99.74 plus or minus 0.15 percent at a water flux of 19.7 plus or minus 4.3 gfd in 35 tests using synthetic seawater feed at 1500 psi). Initial 500-hour tests in synthetic seawater indicate low flux decline properties. Preliminary tests showed these membranes to be resistant to 50 ppm chlorine at neutral pH's, IN HCl and boiling water. Infrared spectroscopic studies showed that the urea linkages were formed by the reaction of polyethylenimine (PEI) and tolylene 2,4-disocyanate (TDI). Also unreacted primary and secondary amine groups of PEI condensed (with elimination of ammonia) during the heat-cure step to form additional crosslinking. The average thickness of the PEI-TDI coating was found to be less than 2100 A. The membrane was found to reject organic solutes to a greater extent than any commercially available membrane. All but two of twenty-five organic solutes studies were rejected at 80 percent of greater. This membrane also was stable at temperatures up to 165F. The membrane was not resistant to chlorine concentrations of lppm. Extended term reverse osmosis testing (under the above conditions) of 1200 hours showed the membrane to exhibit water fluxes above 18 gfd at rejections greater than 99.4 percent. The membrane was found to be applicable to both spiral wrap and tubular reverse osmosis configurations. (OWRT)
W76-03151

FINAL REPORT--DETERMINING FEASIBILITY OF ALTERNATIVE APPROACHES OF OBTAINING SOLID-DRY BRINE EFFLUENT FROM DESALINATION PLANTS AT INLAND LOCATIONS,
Westinghouse Electric Corp., Lester, Pa.
S. Lemezis, C. J. Bowden, R. L. Pryor, and G. P. Chanko.
Available from the National Technical Information Service, Springfield, Va 22161 as PB-233 072, $5.50 in paper copy, $2.25 in microfiche. Office of Saline Water Report INT-OSW-RDPR-74-971, May 1974, 109 p. OSW 14-30-2659.

Descriptors: *Desalination, *Brine disposal, *Desalination plants, Feasibility studies, Alternative water use, *Distillation, Waste water treatment.
Identifiers: Seeded slurry recycle, Blowdown.

The disposal of brine wastes that are generated from all known desalting processes is becoming a problem of major dimensions. Pollution control regulations being adopted by the various States and the Federal Government may well prevent use of the traditional methods such as deep-well injection or return of the concentrate to the original water source. This problem looms so large that the use of known desalination methods for deriving potable water from brackish supplies at inland locations may be severely limited. The process upon which our study is based is a specialized MSF evaporator plant operating on a seeded slurry recycle system. The contract specifies that this plant should treat blowdown from a conventional MSF plant initially desalting the specified waters. In an actual plant intended to purify the specified waters and reduce the blowdown to a solid residue, the basic MSF plant and the first loop of the processing plant should be combined into a single MSF train operating on a seeded slurry recycle system. (OWRT)
W76-03152

FUTURE APPLICATIONS OF DESALTING PROCESSES FOR REDUCTION OF INDUSTRIAL WATER POLLUTION,
Stanford Research Inst., Menlo Park, Calif.
C. W. Marynowski, C. F. Clark, and R. C. Phillips.
Available from the National Technical Information Service, Springfield, Va 22161 as PB-225 124, $4.50 in paper copy, $2.25 in microfiche. Office of Saline Water Report INT-OSW-RDPR-73-898, June 1973. 55 p, 6 fig, 11 tab, 106 ref. OSW 14-30-3137.

Descriptors: *Desalination processes, *Applications methods, Economics, *Industrial wastes, Pollution abatement, Waste water treatment, Powerplants.
Identifiers: Fertilizer plants, Steel mill.

The purpose of this study was to examine the major water-using industries to identify several specific attractive applications of desalting processes, and to evaluate the technical and economic feasibility of the selected illustrative applications. Three applications analyzed in detail are relatively novel. One representing ion exchange treatment of ammonium nitrate plant wastes, is in use at a single plant; the second; representing evaporation of steel mill waste ammoniacal liquor, is being installed; and the third, representing the treatment of power plant stack gas scrubber blowdown by electrodialysis and evaporation, is conceptual. If they prove to be practical, similar processes could be widely adopted, creating new markets for desalination equipment and related facilities. Estimates are made of the capacity of wastewater treatment equipment that will be needed for effluent demineralization by selected industries, and the corresponding investment and operating expenses. Recommendations are made on the direction of research efforts needed to aid and implement the use of desalting techniques for reduction of industrial water pollution. (OWRT)
W76-03153

VERTICAL TUBE DISTILLATION DESALTING STATE-OF-THE-ART (1971),
Hittman Associates, Inc., Columbia, Md.
R. Blevitt, and H. M. Curran.
Available from the National Technical Information Service, Springfield, Va 22161 as PB-224 277, $6.00 in paper copy, $2.25 in microfiche. Office of Saline Water Report INT-OSW-RDPR-73-896, November 1972. 142 p, 25 fig, 17 tab, 19 ref. OSW 14-01-001-1748.

Descriptors: *Desalination, Desalination apparatus, *Distillation, Economics, Cost analysis, *Reviews, Design, Performance, Desalination plants, *Evaporation.
Identifiers: *Vertical tube evaporators, Desalting economics.

The state-of-the-art design, performance, and economics of downflow thin film vertical tube evaporator (VTE) desalting plants were analyzed and reviewed. Both single- and dual-purpose plants ranging in size from 1 to 250 MGD capacity were evaluated. The VTE has been in use for some time, but its application in large scale desalting projects is only 10 years old. The largest U.S. commercial plant is 1 MGD (11 effects at a performance ratio of 9.3) and the largest experimental test bed is also 1 MGD (17 effects, performance ratio of 13.2). Designs ranging up to 250 MGD have

been prepared. Recent innovations include integration of multistage flash (MSF) preheaters with the VTE equipment yielding apparent economies in materials, fabrication, and operation. Current technology emphasizes the use of enhanced surfaces for improvement of evaporation/condensation heat transfer. Concrete lined steel appears to offer long term corrosion resistance to hot seawater brines. Current plants and designs yield from 0.75 to 0.85 pounds of product water per 1000 Btu (initial heating steam) per effect of concentration ratios of 2.5 to 3.0. Two and three inch diameter evaporator tubes of Al-brass or 90-10 CuNi currently are the most attractive materials. VTE desalting plants are currently undergoing continuous improvements in process configuration, materials of construction, and fabrication technology. These improvements are expected to yield reductions in desalting costs. (OWRT)
W76-03154

EVALUATION OF ANISOTROPIC, IONOGENIC MEMBRANES (DIAFLO UM-SERIES) FOR SELECTIVE REMOVAL OF DIVALENT CATIONS AND ANIONS FROM BRACKISH WATER BY REVERSE OSMOSIS,
Amicon Corp., Lexington, Mass.
H. Shathmann, R. A. Cross, T. R. Rich, and B. E. Carroll.
Available from the National Technical Information Service, Springfield, Va 22161 as PB-223 702, $5.00 in paper copy, $2.25 in microfiche. Office of Saline Water Report INT-OSW-RDPR-73-894, October 1973. 81 p, 30 fig, 16 tab, 11 ref, append. OSW 14-30-2640.

Descriptors: *Desalination, Desalination plants, *Membranes, Membrane processes, Brackish water, *Reverse osmosis, Pilot plants, Cations.
Identifiers: Cellulose acetate, *Ultrafiltration membranes, Polyanion, Polycation.

A series of asymmetric membranes made from a polyelectrolyte complex resin has been evaluated by reverse osmosis tests for the selective removal of divalent ions from brackish waters. Three different types of membranes were studied. All three membranes were made from the same basic polymer, i.e., the reaction adduct of a polyanion (polysodium styrene sulfonate) and a Polycation (polyvinyl benzyltrimethylammonium chloride). During first phase of study, the membrane was tested over short time periods with single salt solutions. The second phase consisted of long term tests (ca. 1000 hrs.) to evaluate membrane compaction and fouling using brackish and sea water feeds. The product flux of all three membranes increased linearly with applied hydrostatic pressue up to 600 psig. The average flux increase per 100 psi pressure difference is about 20 gfd. Long term evaluation indicated that compaction was of the same order of magnitude as that observed with cellulose acetate membranes. The rejection of monovalent and divalent ions did not change significantly with time. (OWRT)
W76-03155

DESIGN, CONSTRUCTION, AND FIELD TEST EVALUATION OF A HOLLOW FINE FIBER MODULE,
Monsanto Research Corp., Durham, N.C.
T. A. Orofino, R. L. Leonard, J. C. Berry, T. E. Britt, and J. A. Carden.
Available from the National Technical Information Service, Springfield, Va 22161 as PB-223 762, $5.00 in paper copy, $2.25 in microfiche. Office of Saline Water Report INT-OSW-RDPR-73-893, October 1973. 70 p, 6 fig, 7 tab, 5 ref, 7 append. OSW 14-30-2773.

Descriptors: *Desalination, Desalination plants, *Pilot plants, Membrane processes, Membranes, *Reverse osmosis, *Brackish water, Design.
Identifiers: *Hollow fine fiber modules, Double cartridge looped fiber, Double end seal cartridge, Radial flow cartridge.

A nominal 20,000 gpd hollow fiber module of single-cartridge, radial flow design was constructed and field-tested for three months at the Office of Saline Water, Roswell, N.M. test site. Preparatory work included detailed engineering and economic evaluation of two alternate, axial flow modules also of nominal 20,000 gpd productivity, and fabrication of an instrumented test loop to accommodate the unit finally built. The module evaluated at Roswell showed good flux stability throughout the test period, exceeding target performance with regard to module output and volumetric efficiency. Salt rejection remained at 90% target for the first forty days of continuous operation, declined slightly but abruptly on one particular occasion of feed interruption, and finally stabilized at 85% for the remainder of the test. Average performance between Day 31 and Day 90 of the three-month period was 23,200 gpd (70 F), 3.13 gfd (70 F), 6,840 gpd/ft3, and 86.7% rejection, operating at 300 psig and approximately 30% recovery from 3600 ppm Roswell No 1 feed. (OWRT)
W76-03156

FINAL ANNUAL REPORT-VERTICAL TUBE EVAPORATOR MULTISTAGE FLASH TEST BED PLANT, FREEPORT, TEXAS, APRIL 1, 1972 TO MARCH 31, 1973.
Bechtel Corp., San Francisco, Calif.
Available from the National Technical Information Service, Springfield, Va 22161 as PB-239 399, $11.00 in paper copy, $2.25 in microfiche. Office of Saline Water Report INT-OSW-RDPR-74-999, (1973). 412 p, 113 fig, 35 tab, 4 append. OSW Contract 14-30-3060.

Descriptors: *Desalination plants, *Flash distillation, Evaporators, Heat transfer, Operations, Nozzles, Texas, Scaling, Treatment facilities, Waste water treatment.
Identifiers: Distributor nozzles, Freeport(Tex), *Vertical tub evaporators, VTE/MSF test plant(Desalting).

Volume I describes the second year of operation of the VTE/MSF Test Bed Plant at Freeport confirmed the overall operability of the coupled plant. The plant operates stably and recovers smoothly from upsets. The development program objectives were generally met. The following parameters affecting heat transfer coefficients in the doubly-fluted VTE tubes were investigated: temperature, heat flux, brine feed thermal quality, liquid loading, steam quality, venting. The plant operated for a total time of more than 11,000 hours during its two-year life. During the second year, a total of 207,422,000 gallons of water was produced, and the plant operated with a 70.2-percent onstream factor. The plant was shut down on March 23, 1973. At the present time there are no plans to continue its operation. Volume II is comprised exclusively of computer printouts of development runs. (OWRT)
W76-03157

WATER PURIFICATION MEMBRANES AND METHOD OF PREPARATION,
National Aeronautics and Space Administration, Moffett Field, Calif. Ames Research Center.
For primary bibliographic entry see Field 5D.
W76-03171

CONTINUED STUDIES ON THE USE OF A MIXED CHROMATE-PHOSPHATE INHIBITOR IN DESALINATION SERVICE, FINAL REPORT,
Dow Chemical Co., Midland, Mich.
B. D. Oakes.
Available from the National Technical Information Service, Springfield, Va 22161, as PB-248 977, $5.00 in paper copy, $2.25 in microfiche. OWRT/S-1976/9, November 1972. 77 p, 38 fig, 8 tab. OSW-14-01-0001-2150.

Descriptors: *Desalination, *Distillation, *Sea water, *Corrosion, *Water chemistry, Copper alloys, Steel alloys, *Inhibition.
Identifiers: Materials of construction.

Continued testing of a chromate-phosphate corrosion inhibitor developed for use in desalination systems made of mild steel and copper alloys, show the inhibitor to look promising for use in large systems. Low levels of the inhibitor, 1 part per million (ppm) chromate plus 9 ppm phosphate, effectively control the corrosion of mild steel, stainless steels and copper alloys in small plants producing 2 to 3 thousand gpd of fresh water. This production is achieved at dissolved oxygen levels of from near zero to as high as 1 ppm. The method is potentially useful in new plants that would be entirely constructed of mild steel. It appears the method could also be used for existing plants experiencing excessive corrosion problems on copper and steel alloy surfaces. A practical solution to the scaling problem occurring with the inhibitor use has already been worked out. Other solutions undoubtedly exist. (OWRT)
W76-03190

NONMETALLICS - THEIR PERFORMANCE IN THE DESALINATION ENVIRONMENT,
Dow Chemical Co., Midland, Mich.
J. A. Manning, Jr., and S. V. Carleton.
Available from the National Technical Information Service, Springfield, Va 22161, as PB-248 709, $7.75 in paper copy, $2.25 in microfiche. OWRT/S-1976/6, April 1975. 289 p, 36 fig, 71 tab, 5 ref. OSW 14-30-3111.

Descriptors: *Desalination, *Distillation, *Sea water, Construction materials, *Corrosion, *Protective coatings, Cements, Plastic pipes, Resins, Paints.
Identifiers: *Non metallics, Fiber reinforced plastics.

This report describes the testing of nonmetallic materials of construction and their performance in a desalting environment at the OSW Materials Test Center at Freeport, Texas. Of seventy-three paint and coating systems tested in treated sea water, sixty were considered satisfactory for desalination plant service at 110F; only eighteen systems were rated as adequate at 250F. Baked phenolic or fludized bed-polyphenylene sulfide types should be considered for high temperature operations. Nineteen fiber reinforced plastic (FRP) laminate systems, thirteen thermoplastic types and fifteen commercial FRP piping systems were evaluated at regular intervals over a total exposure period of fifteen months. Polysulfone was an outstanding thermoplastic in 250F sea water. Prekrete (Trademark) G-8 was the only corrosion resistant cement found suitable for use in 250F sea water. (OWRT)
W76-03191

RELATIONSHIPS OF CORROSION RATES TO WATER CHEMISTRY IN THE FREEPORT TEST BED PLANT,
Dow Chemical Co., Midland, Mich.
J. A. Manning, Jr., S. V. Carleton, and C. F. Schrieber.
Available from the National Technical Information Service, Springfield, Va 22161, as PB-248 710, $5.50 in paper copy, $2.25 in microfiche. OWRT/S-1976/7, June 1973. 111 p, 33 fig, 11 tab, 35 ref. OSW 14-30-3080.

Descriptors: *Desalination, *Distillation, *Sea water, *Corrosion, *Water chemistry, *Coatings, Copper alloys, Steel alloys.
Identifiers: Materials of construction.

The corrosion rates in this report are actual corrosion rates and not just relative values. Average corrosion rates based on coupon weight loss are in close agreement with instantaneous corrosion rates obtained by instrument. The oft-times

catastrophic corrosion rates obtained in an operating plant when Dissolved Oxygen (DO), CO2, and pH are not properly controlled are discussed along with the detrimental effect of H2S on materials behavior. High DO is the most detrimental environmental factor in the corrosion of copper and steel. Instantaneous corrosion rate monitoring instrumentation is an excellent means of detecting air in leakage and resultant high corrosion of steel or copper alloys. Shutdowns and startups should be minimized with a fresh water wash and drain following shutdown. Corrosion rates during cyclic plant chlorination were high. (OWRT)
W76-03192

DEVELOPMENT OF VERTICAL TUBE FOAM EVAPORATION FOR DESALINATION,
California Univ., Berkeley. Sea Water Conversion Lab.
H. H. Sephton.
Available from the National Technical Information Service, Springfield, Va 22161, as PB-248 667, $6.00 in paper copy, $2.25 in microfiche. OWRT/S--1976/17, June 1975. 133 p, 65 fig, 21 ref. OSW 14-30-2559.

Descriptors: *Desalination, *Distillation, *Seawater, *Heat transfer, Surfactants, *Interfaces, Pilot plants.
Identifiers: *Vertical tube evaporation, Foamy two phase flow, *Fluted tubes, *Corrugated tubes, *Interface enhancement.

A vertical tube evaporation (VTE) pilot plant facility capable of testing full-sized distillation tubes in an 18-tube bundle to provide comparative data, under process conditions relevant to projected large plant operation, is described. Double-fluted and spiral-corrugated distillation tubes were tested in the upflow mode with fresh water, brine and seawater feeds. A novel, proprietary method of brine-side enhancement was applied: The interface enhancement method (1) produced overall VTE heat transfer coefficient and distillate productivity rate enhancements of up to 200 percent over and above VTE performance data obtained with these enhanced tubes under comparable standard upflow process conditions. This interface enhancement method depends upon the addition of selected surfactants to the feed brine in a few parts per million (ppm) concentration and upon establishing a foamy two-phase flow condition over the heat transfer surface. Overall heat transfer enhancements about 100 percent were reproducibly demonstrated under realistic upflow VTE conditions with both double-fluted and spiral-corrugated distillation tubes using seawater feed having about 5 ppm of a fully biodegradable commercial surfactant added thereto. Simultaneous tubeside pressure drop reductions by a factor ranging from 3 to 10, and significant upflow VTE stabilization effects were also demonstrated. (OWRT)
W76-03256

RESEARCH AND DEVELOPMENT OF NS-1 AND RELATED POLYSULFONE HOLLOW FIBERS FOR REVERSE OSMOSIS DESALINATION OF SEAWATER,
Gulf South Research Inst., New Orleans, La.
I. Cabasso, E. Klein, and J. K. Smith.
Available from the National Technical Information Service, Springfield, Va 22161, as PB-248 666, $6.00 in paper copy, $2.25 in microfiche. Office of Water Research and Technology, OWRT/S--1976/4, July 1975. 145 p, 79 fig, 16 tab, 24 ref. 14-30-3165.

Descriptors: *Desalination, *Membranes, *Porosity, *Reverse osmosis, Seawater.
Identifiers: Composite membranes, Polysulfone, *Hollow fibers, Polyvinylpyrrolidone, NS-100, Hollow porous fibers, Polyethylene-imine.

Polysulfone hollow fibers for Reverse Osmosis desalination of water were investigated. Parameters which influence fiber properties include spinning solution composition and viscosity, spinning temperature, solution pumping rates, choice of coagulation agents, coagulation temperature and nascent fiber drawing rate. The most satisfactory fibers were produced by wet-dry spinning of a solution containing polysulfone-polyvinylpyrrolidone-dimethylacetamide. Porosity, mean and maximum pore size, ultrafiltration rate, and void volume were measured. Macrovoids were observed to occur in the fibers according to variations in solution viscosity, quench media, and coagulation rate. The deposition of ultrathin coatings on polysulfone hollow fiber was studied extensively. Coating and bundle assembly techniques were found to affect the performence of composite reverse osmosis fiber. Preheat treatment led to an increase in the desalination ability of NS-1, a polyethylenimine-isocyanate coated polysulfone hollow fiber. (OWRT)
W76-03257

NEW POLYMERS FOR DESALINATION MEMBRANES,
O. Vogl.
Available from the National Technical Information Service, Springfield, Va 22161, as PB-248 668, $4.00 in paper copy, $2.25 in microfiche. OWRT/S--1976/3, (1974). 43 p, 7 tab, 8 fig, 11 ref. 14-30-3146.

Descriptors: *Reverse osmosis, *Membranes, *Desalination, *Polymers.
Identifiers: *Asymmetric membranes, Casting variables, Polyamides, Glass transition, Water transport, Composite membranes, Copolyamides.

The objective of this project is the development of materials and techniques which will allow the formulation of membranes suitable for use in desalination by reverse osmosis. Major emphasis was placed on actual reverse osmosis testing of candidate materials and on obtaining a more thorough fundamental understanding of the physical properties of these materials. The major difficulty encountered in the fabrication of asymmetric membranes from copolyamides is their limited solubility in good casting solvents. In an attempt to overcome this problem, the effects of the incorporation of additional comonomers on the solubility and desalination performance of these materials were investigated. In addition, several new film-forming copolyamides were synthesized and characterized. (OWRT)
W76-03258

IN-SITU-FORMED CONDENSATION POLYMERS FOR REVERSE OSOMSIS MEMBRANES-FINAL REPORT,
Midwest Research Inst., Minneapolis, Minn. North Star Research Div.
J. E. Cadotte, K. E. Cobian, R. H. Forester, and R. J. Peterson.
Available from the National Technical Information Service, Springfield, Va 22161, as PB-248 670, $5.00 in paper copy, $2.25 in microfiche. Office of Water Research and Technology, OWRT/S--1976/2, July 1975. 85 p, 23 tab, 16 fig, 17 ref. 14-30-2883.

Descriptors: *Desalination, *Membranes, *Reverse osmosis, *Polymers, *Porosity.
Identifiers: *In-Situ Condensation, Salt rejection, Polysulfone, Water flux, Condensation polymers, Furfuryl alcohol, Polymethacrylate, Polyimadazopyrrolones, NS-100, NS-200, Chlorine stability.

A new, highly promising reverse osmosis membrane for single pass seawater desalination--NS-200--was developed. This membrane consisted of a sulfonated poly(furfuryl alcohol) resin deposited on a microporous polysulfone support. Fabrication was much simpler than for NS-100 membranes. Optimization of the NS-200 membrane fabrication parameters was carried out to yield a membrane with water flux of about 20 gfd at 99.9 percent salt rejection when operated on synthetic seawater at 1500 psig and 25C. This membrane was more durable than NS-100 during handling, was operable in the pH range of at least 3.2 to 9.4, was very effective in rejecting inorganic salts, urea, and boric acid, and was not subject to membrane compaction under high pressures. Tests of 1000 hours duration with synthetic seawater were highly successful. Both the NS-200 membrane and the previously developed NS-100 demonstrated excellent resistance to chloramine as the feed stream sterilizing agent, but not to hypochlorite. (OWRT)
W76-03259

3B. Water Yield Improvement

A LABORATORY INVESTIGATION OF THE EFFECT OF SURFACE FILMS ON WIND INDUCED REAERATION,
Massachusetts Univ., Amherst. Water Resources Research Center.
For primary bibliographic entry see Field 5B.
W76-03100

HANDBOOK OF APPLIED WEATHER MODIFICATION, PART 1. COLD CLOUD MODIFICATION SUBSYSTEM, VOLUME 1. CUMULUS CLOUD TREATMENT.
Naval Weapons Center, China Lake, Calif. Research Dept.
Available from the National Technical Information Service as AD-A 007 333, price 4.50 Report NWC TP 5160, Part 1, Volume 1, February 1975. 54 p, 27 fig, 1 tab, 11 fef.

Descriptors: *Weather modification, *Cloud seeding, *Artificial precipitation, Precipitation(Atmospheric), Cloud physics, Equipment, Aircraft, Nucleation, Silver iodide, Clouds, Rainfall, Meteorology.
Identifiers: Cumulus clouds, Pyrotechnic cloud seeding, Aerial cloud seeding, Weather modification equipment.

The stimulation of rainfall by seeding cumulus clouds with silver iodide has been investigated extensively since the ice-nucleating properties of these crystals were discovered in 1947. Since that time techniques to dispense silver iodide into supercooled clouds have improved to a point where investigators, particularly those using dynamic methods of cloud seeding from aircraft, are having considerable success in augmenting precipitation and some success in inhibiting precipitation. Generally, modifiable clouds fall within the classification categories of cumulus or stratus cloud types. Factors controlling the type and degree of cumulus development were discussed, and explanatory diagrams were presented. Unsheared cumulus clouds are seeded by emplacement of glaciogenic (ice-producing) nuclei in updrafts at or near the top of those clouds in the warmest temperature zone at which the nucleant is effective. Sheared clouds are seeded in updrafts on the upshear side at the effective temperature level. Techniques useful for seeding cumulus clouds with glaciogenic nuclei for rain augmentation were discussed. Airborne devices the Navy uses to modify cold cumulus clouds were described. External and internal properties of both the family of pyrotechnic catalyst generator cartridges and the SUU-53/A cartridge dispenser were delineated. The safety features of these devices were especially emphasized. (Sims-ISWS)
W76-03101

AN EVALUATION OF WEATHER MODIFICATION ACTIVITIES IN THE TEXAS HIGH PLAINS,
Texas A and M Univ., College Station. Center for Applied Geosciences.
J. R. Scoggins, P. Das, J. F. Griffiths, H. O. Hartley, and R. D. Lacewell.

Texas A and M Univ., College Station. Center for Applied Geosciences.

Descriptors: *Cloud seeding, *Weather modification, Texas, Cotton, Statistical methods, Rainfall, Hail, Radar, Thunderstorms, Numerical analysis, Evaluation.
Identifiers: *Texas high plains, Crop damage, Crop loss.

This report results of a study to evaluate the effectiveness of cloud seeding in the Texas High Plains for the months of May through October during the 4-yr period 1970-73. The effects of seeding were examined on rainfall graphically, and on both rainfall and hail by the analysis of variance method and the chi-square goodness-of-fit test. The amount of damage to cotton was taken as the primary indicator of weather damage. Statistical analysis of rainfall data indicated that cloud seeding does not influence rainfall. Also, a statistical analysis of cotton losses attributable to hail and insurance damages paid due to hail damage on cotton indicated that the hail suppression program did not significantly affect cotton hail damage. The outline of an operational, one-dimensional, numerical model of hail-producing thunderstorms was developed to study the possibility of predicting the occurrence and severity of hailstorms. No. relationship could be ascertained between radar-echo coverage and such severe-weather phenomena as hailstorms, tornadoes, and funnel clouds. The limitations of the data were given. (Jones-ISWS)
W76-03104

C. E. JACOB'S STUDY ON THE PROSPECTIVE AND HYPOTHETICAL FUTURE OF THE MINING OF THE GROUND WATER DEPOSITED UNDER THE SOUTHERN HIGH PLAINS OF TEXAS AND NEW MEXICO,
New Mexico Inst. of Mining and Technology, Socorro.
For primary bibliographic entry see Field 4B.
W76-03363

3C. Use Of Water Of Impaired Quality

EFFECT OF IRRIGATION ON SOME PHYSICOCHEMICAL PROPERTIES OF CISCAUCASIAN CHERNOZEMS OF THE SECOND TERRACE OF THE DON RIVER, (IN RUSSIAN),
Rostov-on-Don State Univ. (USSR). Research Inst. of Biology.
A. Ya., Vigutova, E. F. Ryazanova, V. G. Movchan, and G. N. Shevtsova.
Izv Sev-Kavk Nauchn Tsentra Nyssh Shk Estestv Nauki. 2(3): 22-25. Illus. 1974.

Descriptors: *Irrigation, *Chernozems, Rivers, Aggregates, Salinity, *Saline soils, Terracing.
Identifiers: Ciscaucasian, Physiochemical conditions, Solonetzification, *USSR(Don River).

The degree and character of changes of the physicochemical properties and salt regime of Ciscaucasian chernozems of the second terrace of the Don River (USSR) irrigated for 20 yr is compared with unirrigated soils. Irrigation did not have a significant effect on the texture of the soils, unit weight and porosity, but some tendency toward an increase of density and decrease of porosity of the upper 0.5-m layer of soil was noted. The changes in the texture of the irrigated soils relative to the unirrigated were displayed by a decrease in the content of agronomically valuable aggregates and a decrease in their water stability. The seasonal dynamics of the salt regime of the irrigated and unirrigated soils are presented and factors causing salinization and solonetzification of irrigated soils are pointed out. --Copyright 1975, Biological Abstracts, Inc.
W76-03022

THE USE OF ALCOHOL DISTILLERY-GENERATED WASTE WATERS FOR IRRIGATION (ISPOL' ZOVANIYE STOKOV SPIRTOZAVODOV DLYA OROSHENIYA),
For primary bibliographic entry see Field 5D.
W76-03083

EFFECTS OF GRAZING ON INFILTRATION RATES IN WASTE WATER SPRAY FIELDS,
Agricultural Research Service, Morgantown, W. Va. Plant Science Div.
For primary bibliographic entry see Field 5D.
W76-03124

WATER QUALITY, FOUNTAIN AND JIMMY CAMP VALLEYS, COLORADO, 1973,
Geological Survey, Denver, Colo.
For primary bibliographic entry see Field 5B.
W76-03404

3D. Conservation In Domestic and Municipal Use

URBAN WATER USE IN AUSTRALIA,
Gutteridge, Haskins and Davey Pty. Ltd., Melbourne (Australia).
For primary bibliographic entry see Field 6D.
W76-03272

HOUSEHOLD TECHNOLOGY AND THE DOMESTIC DEMAND FOR WATER,
National Institute of Economic and Social Research, London (England).
For primary bibliographic entry see Field 6D.
W76-03278

3E. Conservation In Industry

ENERGY DEMAND AND WATER RESOURCE MANAGEMENT: SOME ECONOMIC ASPECTS,
New York State Coll. of Agriculture and Life Sciences, Ithaca. Dept. of Agricultural Economics.
For primary bibliographic entry see Field 6D.
W76-03003

ECOLOGY, ECONOMY AND MINING IN VERMONT,
For primary bibliographic entry see Field 5G.
W76-03061

UNCONVENTIONAL NUCLEAR POWER PLANT SITING OPTIONS AND WATER RESOURCE IMPACTS,
Connecticut Univ., Storrs. Inst. of Water Resources.
For primary bibliographic entry see Field 5G.
W76-03135

ENERGY DISSIPATOR AIDS FIGHT AGAINST HIGH PRESSURE PROBLEMS.
For primary bibliographic entry see Field 4B.
W76-03212

MUNICIPAL WASTEWATER PLANT PROBLEMS WITH CYANIDE EFFLUENT REGULATIONS,
Metropolitan Sanitary District of Greater Chicago, Ill. Industrial Waste Div.
For primary bibliographic entry see Field 5D.
W76-03247

EFFLUENT CHARGES, ENVIRONMENTAL QUALITY AND OTHER NATIONAL GOALS: A QUALIFICATION,
Pennsylvania State Univ., University Park. Center for the Study of Environmental Policy.
For primary bibliographic entry see Field 5G.
W76-03268

A SOCIOLOGICAL ASSESSMENT OF ECONOMIC INCENTIVES FOR INDUSTRIAL POLLUTION ABATEMENT,
Pennsylvania State Univ., University Park. Center for the Study of Environmental Policy.
For primary bibliographic entry see Field 5G.
W76-03269

FINANCIAL INCENTIVES AND POLLUTION CONTROL. A CASE STUDY,
Pennsylvania State Univ., University Park. Center for the Study of Environmental Policy.
For primary bibliographic entry see Field 5G.
W76-03270

ENVIRONMENT LAWS MAY CLOSE MANY USA FISH FACTORIES.
For primary bibliographic entry see Field 5G.
W76-03273

DEEPSEA MINERAL UTILIZATION, REGULATION AND ECONOMIC EFFICIENCY,
Delaware Univ., Newark. Dept. of Economics.
For primary bibliographic entry see Field 6C.
W76-03275

REALITY AND PROSPECTS OF THE FISHING INDUSTRY IN ITALY,
A. Bassi.
Review of the Economic Conditions in Italy, Vol 19, No 1, p 15-23, 1975.

Descriptors: *Marine fisheries, *Foreign countries, Commercial fishing, Fish handling facilities, Boats, Government supports, Fish harvest, Africa, Employment, Water rights, International waters, Foreign waters, Jurisdiction, Marketing, Atlantic Ocean.
Identifiers: *Italy, Mediterranean Sea, Territorial waters.

The Italian fishing industry has grown in recent years with the assistance of government supports. Revised laws have helped clear up some of the technical aspects of fishing. There are 4000 Mediterranean fishing vessels, 60 ocean vessels, and 16,000 motorboats, which harvest 350,000 tons of fish a year. The Mediterranean fishing equipment has been modernized, fishing fleets reconstructed, new jobs created, and more economic benefits provided to fishermen. As some African countries have extended their territorial waters Italian trawlers have had to seek other fishing shoals; some have been found along the coasts of South Africa and North America but require expeditions of 150-160 days instead of 40-50 days. The Italian government must seek an international agreement on fishing rights and privileges. A fleet of 110 larger modern ships is proposed. A coordinated plan of incentives for restructuring Italian fishing is necessary by involving fishermen and those in processing, preserving, and distributing fish. New harbors, improved refrigeration facilities, promotion of Mediterranean and frozen fish, and effective fishermen's cooperatives would enhance the economic potential of the indistry. (Buchanan-Davidson--Wisconsin)
W76-03279

COMPARATIVE RIST-COST-BENEFIT STUDY OF ALTERNATIVE SOURCES OF ELECTRICAL ENERGY. APPENDIX A: ENERGY EXPENDITURES ASSOCIATED WITH ELECTRIC POWER PRODUCTION BY NUCLEAR AND FOSSIL FUELED POWER PLANTS.
Division of Reactor Research and Development (USERDA), Washington, D.C.
For primary bibliographic entry see Field 6B.
W76-03281

AN APPLICATION OF DISCRIMINANT ANALYSIS TO DETERMINE THE DEMAND FOR INDUSTRIAL FLOOD PLAIN LOCATION,
Missouri Univ., St. Louis. School of Business Administration.
For primary bibliographic entry see Field 6F.
W76-03283

CHANGING WATER USE IN SELECTED MANUFACTURING INDUSTRIES,
National Bureau of Economic Research, Inc., Washington, D.C.
R. A. Leone, J. R. Ginn, and A-L. Lin.
Available from the National Technical Information Service, Springfield, Va 22161 as AD/A-003 264, $6.75 in paper copy, $2.25 in microfiche. Army Engineer Institute for Water Resources Report No IWR 74-10, October 1974. 164 p, 12 fig, 26 tab, 6 ref, 1 append. DACW 31-72-C-0044.

Descriptors: *Water demand, *Water utilization, *Industrial water, *Sites, Technology, Industries, Water reuse, Industrial production, Transportation, Water costs, Elasticity of demand, Regional development, Planning, Coasts, Inland waterways, Relocation.

Recently major shifts in industrial water use technology have occurred. Several factors are involved: Modernization of technological processes in new plants; changes in water prices as reflected in changes in availability and quality; and stricter water pollution controls. This study was designed to help understand the effect of some of the changes in water cost and quality on technological changes in process design and plant location decisions. A study of steel, pulp and paper, petroleum refining, chemical, aluminum and blast furnaces indicated that water is a necessary but not a sufficient condition for continued growth in water-using industries. Geographic patterns of industry location seemed to be shifting toward areas with favorable water resources but there is considerable change in water use over time. Water for industrial processing is not a major location determinant; rather water for transportation is a more important location determinant. Industrial demand for water is far from inelastic in the range of price changes being experienced. There appear to be clear trade-offs between water-use and more capital extensive process designs. Using cross-section sample data on water use in individual manufacturing plants, a statistically significant relationship between water cost and water demand was found, with demand elasticities of 0.5-1.0. (Buchanan-Davidson--Wisconsin)
W76-03284

INTERDEPENDENCE OF AIR, WATER, AND SOIL POLLUTION CONTROL STRATEGIES IN A POWER PLANT AND A KRAFT MILL,
Battelle Columbus Labs., Ohio.
For primary bibliographic entry see Field 5D.
W76-03297

THE RECOVERY OF FE, MN AND AL FROM A MINE WATER EFFLUENT,
Potchefstroom Univ., for C. H. E. (South Africa). Dept. of Industrial Chemistry.
For primary bibliographic entry see Field 5G.
W76-03312

PRESENT AND FUTURE REQUIREMENTS OF THE CHLOR-ALKALI INDUSTRY FOR EFFECTIVE POLLUTION CONTROL,
Crawford and Russel, Inc., Stamford, Conn.
For primary bibliographic entry see Field 5D.
W76-03497

INDUSTRIAL REQUIREMENTS FOR EFFECTIVE POLLUTION CONTROL. AUTOMOBILE INDUSTRY,
General Motors Corp., Warren, Mich. Environmental Activities Staff.
For primary bibliographic entry see Field 5G.
W76-03498

3F. Conservation In Agriculture

TIME-DEPENDENT LINEARIZED INFILTRATION: II. LINE SOURCES,
Arizona Univ., Tucson. Dept. of Mathematics.
For primary bibliographic entry see Field 2G.
W76-03007

SOLUTION TO THE ONE-DIMENSIONAL LINEAR MOISTURE FLOW EQUATION WITH WATER EXTRACTION,
Arizona Univ., Tucson. Dept. of Soils, Water and Engineering.
For primary bibliographic entry see Field 2G.
W76-03008

DRIP IRRIGATION SYSTEM,
Andco Inc., Buffalo. N.Y. (Assignee).
R. W. Hildebrandt, and H. Hanks, Jr.
U S Patent No 3,917,174, 4 p, 3 fig, 5 ref; Official Gazette of the United States Patent Office, Vol 940, No 1, p 263, November 4, 1975.

Descriptors: *Patents, Irrigation, *Surface irrigation, *Distribution systems, Irrigation practices, Irrigation systems, Irrigation efficiency, Water control, Water distribution(Applied), Flow control.
Identifiers: *Drip irrigation.

An irrigation system comprises: a main supply line for conveying fluid under pressure; a feeder tube having head end connected to the main supply line; control means connected to the feeder tube adjacent the head end for controlling the flow rate of fluid through the feeder tube; means maintaining the fluid at a predetermined pressure at the head end where by a decreasing pressure gradient exists from the head end of the feeder tube towards the downstream end during flow of fluid; and a plurality of emitters of varying flow capacities connected to the feeder tube downstream of the flow rate control. The emitters have relatively lower flow capacities connected to the feeder tube at the head end portion with emitters having progressively relatively higher flow capacities being connected to the feeder tube at respective locations progressively closer to the downstream end of the feeder tube so that substantially equal amounts of fluid are delivered to the plant root areas. (Sinha-OEIS)
W76-03010

DESIGN OF DRIP IRRIGATION MAIN LINES,
Hawaii Univ., Honolulu. Dept. of Agricultural Engineering.
For primary bibliographic entry see Field 8B.
W76-03160

DESIGN OF IRRIGATION RUNOFF RECOVERY SYSTEMS,
Utah State Univ., Logan. Dept. of Agricultural and Irrigation Engineering.
G. E. Stringham, and S. N. Hamad.
Journal of the Irrigation and Drainage Division Proceedings of ASCE, Vol 101, No IR3, p 209-219, September, 1975. 2 fig, 5 ref.

Descriptors: *Irrigation, *Mathematical models, *Design criteria, Water reuse, Runoff irrigation water, Agricultural runoff, Storage requirements.
Identifiers: Irrigation runoff, *Irrigation Runoff Recovery System.

The design of an Irrigation Runoff Recovery System (IRRS) is described and evaluated. Using this system, the need for a cut-back type of irrigation is eliminated by the use of a constant supply stream discharge, a constant discharge from the recirculating pump, a constant furrow discharge, and a constant number of furrows in each set. In order to adjust the set size and furrow discharge rates to accomodate the intermittent flows from recirculating pumps, a design technique has been developed that permits a constant inflow to all furrows of the irrigation, with no net runoff from the field. This is achieved by irrigating the entire set of irrigation fields from the inflow water and collecting the runoff in a storage reservoir. All of the remaining sets, except the last set, are irrigated by both the supply stream and runoff water, recirculated by pump. The last set is irrigated only from the stored runoff water. Thus the layout calls for n + 1 irrigation sets, and at the end, no water should remain in the storage reservoir. This technqiue allows planners to determine the number of furrows to irrigated from the supply and pumped streams, the number of sets and furrows in each, the volume of storage required in tht storage reservoir, and the recirculating pump flow rates. (Kramer-FIRL)
W76-03246

ECONOMIC ANALYSIS OF WHEAT PRODUCTION WITH FERTILIZER UNDER ADEQUATE AND LIMITING IRRIGATION WATER,
Central Arid Zone Research Inst., Jodhpur (India).
K. L. Ram, and A. N. Lahiri.
Indian Journal of Agricultural Research, Vol 8, No 1, p 25-36, 1974. 3 fig, 12 tab.

Descriptors: *Cost-benefit ratio, *Fertilization, *Irrigation, *Return(Monetary), Crop response, Wheat, Asia, Profit, Equations, Optimization.
Identifiers: *India.

The economics of fertilizer induced productivity in experimental wheat crops at Jodhpur, India, both under high and low irrigation levels was examined. The importance of water as an agricultural input, and its efficient utilization in areas where there is a water shortage for irrigation are discussed. Although results indicated that reasonably high wheat production may be achieved under low water conditions by the suitable addition of fertilizer considerations of the economics of fertilizer induced productivity in these conditions would help to formulate a policy about utilization of water resources in smaller areas for intensified production, or alternately, the advantages of diverting water resources over larger areas for cropping. Results revealed wheat production with adequate irrigation and optimum doses of fertilizer of 171.29 kg/ha nitrogen and 131.46 kg/ha superphosphate produced a crop response of 38.29 quintal/ha while under limited moisture conditions, the optimum doses of fertilizer will be 80.12 kg/ha nitrogen and 88.44 kg/ha superphosphate with the maximum crop response of 14.20 quintal/ha. At wheat prices of 90 rupees per quintal the net return over fertilizer cost would be 2568.50 rupees under irrigated conditions and 861.29 rupees under dry conditions. (Auen-Wisconsin)
W76-03277

DYNAMIC SIMULATION OF WATER STORAGE IN FALLOW SOIL AS AFFECTED BY MULCH OF HYDROPHOBIC AGGREGATES,
Texas A and M. Univ., College Station. Dept. of Soil and Crop Sciences; and Texas Agricultural Experiment Station, College Station.
For primary bibliographic entry see Field 2G.
W76-03365

RELATIONSHIPS BETWEEN THE HYDRAULIC CONDUCTANCE OF SURFACE CRUSTS AND SOIL MANAGEMENT IN A TYPIC HAPLUDALF,
Soil Survey Inst., Wageniagen (Netherlands).
For primary bibliographic entry see Field 2G.
W76-03366

MONITORING AGRICULTURAL POLLUTION USING NATURAL FLUORESCENCE,
Saskatchewan Research Council, Saskatoon.
For primary bibliographic entry see Field 5A.
W76-03387

HYDROLOGY OF THE SOUTH PLATTE RIVER VALLEY, NORTHEASTERN COLORADO,
Geological Survey, Denver, Colo.
For primary bibliographic entry see Field 4B.
W76-03398

ANALOG MODEL STUDY OF THE HYDROLOGY OF THE SAN LUIS VALLEY, SOUTH-CENTRAL COLORADO,
Geological Survey, Denver, Colo.
For primary bibliographic entry see Field 4B.
W76-03403

4. WATER QUANTITY MANAGEMENT AND CONTROL

4A. Control Of Water On The Surface

PROCEEDINGS OF THE CONFERENCE ON INTERDISCIPLINARY ANALYSIS OF WATER RESOURCE SYSTEMS.
American Society of Civil Engineers, New York.
For primary bibliographic entry see Field 6A.
W76-03005

DESIGN OF STORM SEWER NETWORKS,
Illinois Univ. at Urbana-Champaign. Dept. of Civil Engineering.
B. C. Yen, and A. S. Sevuk.
Journal of the Environmental Engineering Division, American Society of Civil Engineers, Vol 101, No EE4, Proceedings Paper 11503, p 535-553, August 1975. 4 fig, 5 tab, 15 ref, 2 append. OWRT B-043-Ill(10) and C-A/23(9023)(2). 14-31-0001-3078, and 14-31-0001-9023.

Descriptors: *Urban drainage, *Urban hydrology, *Storm drains, *Model studies, *Computer models, *Design, Urbanization, Routing, Sewers, Storm runoff, Urban runoff, Runoff, Storm water, Floods, Drainage, Environmental engineering, Hydraulic design.
Identifiers: *Illinois Storm Sewer System Simulation(ISS) Model, *Storm Water Management Model(SWMM), *Chicago method, *Steady-flow routing, *Kinematic-wave model, Retention storage.

Five methods for design of storm and combined sewers were compared by determining the size of the sewers of an example network. The Illinois Storm Sewer System Simulation (ISS) Model appears to be the most accurate method suitable for large expensive networks, and can also be used to study on-line retention storage. The conventionally used steady-flow routing method with shifting of hydrographs due to sewer flow time is simple and does not require use of a computer; thus it can be used for small networks and when high accuracy is not required. The version of steady-flow routing method without time shifting of hydrographs is not recommended because it consistently gives overdesign. The Chicago method provides no improvement in design and yet is more complicated than the time-shifting version of steady-flow routing method. The EPA Storm Water Management Model and the kinematic-wave model are improvements over the steady-flow routing method. They can be used for large networks but presumably are less accurate than the ISS Model. (Bender-ISWS)
W76-03006

HARVESTING AS A CONTROL FOR AQUATIC PLANTS,
Wisconsin Univ. Extension, Madison.
For primary bibliographic entry see Field 5G.
W76-03058

METEOROLOGICAL AND HYDROLOGICAL DATA REQUIRED IN PLANNING THE DEVELOPMENT OF WATER RESOURCES (PLANNING AND DESIGN LEVEL),
World Meteorological Organization, Geneva (Switzerland).
V. G. Andrejanov.
Operational Hydrology Report No 5, WMO-No 419, 1975. 45 p, 1 tab, 57 ref.

Descriptors: *Streamflow, *Hydraulic structures, *Meteorological data, *Hydrologic data, Climatic data, Flow, Flow rates, Runoff, Water levels, Precipitation(Atmospheric), Rainfall, Dams, Bridges, Rivers, Low-flow frequency, High flow, Hydraulics, Hydrology, Data processing.

This report was devoted to a discussion of the methodology for calculating meteorological and hydrological characteristics and parameters and to methods of calculating individual elements of the hydrometeorological regime; it also contained a summary of the characteristics and parameters required in the planning of various structures and measures for various types of water resource use. (Sims-ISWS)
W76-03103

WATER SUPPLIES FOR LOW-INCOME COMMUNITIES IN DEVELOPING COUNTRIES,
Birmingham Univ. (England). Dept. of Civil Engineering.
For primary bibliographic entry see Field 5F.
W76-03114

ATMOSPHERIC REAERATION IN A RIVER USING PRODUCTIVITY ANALYSIS,
Virginia Univ., Charlottesville.
For primary bibliographic entry see Field 5G.
W76-03115

SOUTH PLATTE RIVER FLOW CORRELATIONS,
Colorado State Univ., Fort Collins. Dept. of Civil Engineering.
For primary bibliographic entry see Field 4B.
W76-03117

FEEDBACK FROM FIELD STUDIES OF HYDRAULIC DREDGES,
Texas A and M Univ., College Station. Dept. of Civil Engineering.
For primary bibliographic entry see Field 8C.
W76-03122

RESERVOIR MANAGEMENT MODELS,
Yale Univ., New Haven, Conn. School of Organization and Management.
M. J. Sobel.
Water Resources Research, Vol 11, No 6, p 767-776, December 1975. 9 tab, 51 equ, 27 ref.

Descriptors: *Reservoir storage, *Control, *Water policy, *Management, *Optimization, *Reservoir releases, *Stochastic processes, Economics, Design, Decision making, Dynamic programming, Algorithms, Equations, Mathematical models, Operations research, Linear programming.
Identifiers: Reservoir capacity, Discrete time, Linear decision rule, Chance-constrained programming, Deterministic models, Multiple-reservoir systems, Multi-item inventory systems, Cost minimization, Monotone policies.

The optimal policies for several discrete control models of reservoir storage are characterized. Most of the models are stochastic, and they are prompted by operating problems of regulating the amounts of water discharged from reservoirs. The design problem of selecting reservoir capacity induces two models herein, one of them being deterministic. Each characterization is exploited to simplify the numerical solution of heretofore formidable problems. Some of the results exploit analogies between multi-item inventory theory and systems of multiple reservoirs. In particular, it is observed that the 'linear decision rule' label in the water resource literature ordinarily arises in contexts where either (1) a myopic policy is optimal, or (2) a multiple-reservoir optimal release policy, as a function of the vector of reservoir contents, possesses a Jacobian matrix whose values are between zero and one. Either (1) or (2) impressively reduces the computational burden that would otherwise be carried. (Bell-Cornell)
W76-03162

INTERVENTION ANALYSIS IN WATER RESOURCES,
Waterloo Univ., (Ontario). Dept. of Civil Engineering.
For primary bibliographic entry see Field 2E.
W76-03165

USE OF RISK PREMIUMS IN CHANCE-CONSTRAINED DYNAMIC PROGRAMING,
New South Wales Univ., Kensington (Australia). School of Civil Engineering.
For primary bibliographic entry see Field 6A.
W76-03166

ESTUARY TO BE STUDIED AS D.C. WATER SOURCE,
Illinois State Univ., Normal. Coll. of Applied Science and Technology.
For primary bibliographic entry see Field 5F.
W76-03208

DESIGN OF IRRIGATION RUNOFF RECOVERY SYSTEMS,
Utah State Univ., Logan. Dept. of Agricultural and Irrigation Engineering.
For primary bibliographic entry see Field 3F.
W76-03246

RESEARCH NEEDS FOR WATER RESOURCES CONTROL IN CALIFORNIA.
California State Water Resources Control Board, Sacramento. Div. of Planning and Research.
For primary bibliographic entry see Field 5G.
W76-03265

RESOURCE ALLOCATION UNDER UNCERTAINTY,
California Univ., Berkeley. Graduate School of Public Policy.
For primary bibliographic entry see Field 6A.
W76-03266

TWO DECADES OF FLOOD-PLAIN MANAGEMENT: THE TVA REGIONAL EXPERIENCE,
Tennessee Valley Authority, Knoxville. Local Flood Relations.
For primary bibliographic entry see Field 6F.
W76-03271

ATTEMPTS AT A COMPARATIVE ECOLOGIC ANALYSIS OF FAGUS-ABIES FORESTS IN THE SWISS JURA MOUNTAINS (WEISSENTIEN AND CHASSERAL), (IN GERMAN),
J. Pfadenhauer.
Veroeff Geobot Inst Eidg Tech Hochsch Stift Reubel Zyer, 50, p 5-60, 1973, Illus. English summary.

Descriptors: *Forests, Analysis, Climates, Soils, Precipitation(Atmospheric), Winds.
Identifiers: Abies, Chasseral, Fagus, Jura mountains, Weissentein, Meteorological parameters.

Meteorological parameters were measured across a transect from N to S at Chasseral and on the side at Weissenstein. Three main plant forest communities were distinguished and analyzed: Fagetum typicum, Abieti-Fagetum, and Aceri-Fagetum. Air temperature constitutes the decisive factor in the vertical distribution of the communities. Local variants were conditioned by soil and precipitation. The vertical limits of growth of Abies cannot be defined climatically. Cold-humid climates exclude Abies, e.g. because of snow breakage. The horizontal component of precipitation is discussed separately. In strongly wind-exposed stations the horizontal component may reach 60% of the vertical one.--Copyright 1974, Biological Abstracts, Inc.
W76-03274

RUNOFF MEASUREMENT IN SMALL CATCHMENT AREAS: REGISTRATION AND PRESENTATION OF DATA, (IN NORWEGIAN),
Norges Landbrukshoegskole, Vollebekk.
For primary bibliographic entry see Field 2E.
W76-03280

THE METROPOLITAN WATER DISTRICT OF SOUTHERN CALIFORNIA REPORT FOR THE FISCAL YEAR JULY 1, 1973 TO JUNE 30, 1974.
Southern California Metropolitan Water District, Los Angeles.
1974, 212 p, 17 fig, 47 tab.

Descriptors: *Projects, *Met. Water Dist. of So. Cal., *California, *Water distribution(Applied), Financing, Electric power demand, Hydroelectric plants, Bond issues, Water transfer, Mexican Water Treaty, Desalinization plants, Cost analysis, Right-of-way, Tax rates, Colorado River, Colorado River Aqueduct, Cooling water, Nuclear powerplants, Reservoirs, Water storage, Salinity, Energy, Power, Chlorine, Operation and maintenance, Distribution systems, Water treatment, Engineering, Construction, Hydrography, Legal aspects, Economics.

The Metropolitan Water District of Southern California annual report for the fiscal year ending June 30, 1974, shows that a total 1,248,287 acre-feet of water were delivered to member agencies from the Colorado River and the California Aqueduct. A program was adopted to achieve a 50/50 blend of water from the Colorado River and Northern California by 1976 to reduce salinity. The District agreed to supply cooling water to nuclear power plants in the eastern Mojave Desert and the San Joaquin Valley. Reservoirs in the State Water Project increased their reserve water storage thus enhancing recreational use. A salinity control bill for the Colorado River was signed by President Nixon, which should improve relations with Mexico and relieve salinity problems in the Colorado River Basin. The bill also authorized the construction of a 100 mgd desalting plant to treat briny agricultural return flow. Nearly $39 million in major projects were completed during the year. Composition of the District, assessed property valuations, populations, area, and cost analysis figures are presented. Operation and maintenance of the Colorado River Aqueduct and the distribution system, water treatment, engineering, State Water Project, construction, hydrography, legal, purchasing, personnel, rights-of-way, and financing are discussed. (See W76-03286 thru W76-03295) (Buchanan-Davidson--Wisconsin).
W76-03285

COLORADO RIVER AQUEDUCT OPERATION AND MAINTENANCE.
In: The Metropolitan Water District of Southern California report for the fiscal year July 1, 1973 to June 30, 1974, p 1-9, 5 tab.

Descriptors: *Met. Water Dist. of So. Cal., *Pumping, *Colorado River Aqueduct, *Operation and maintenance, *Electric power costs, *California, Mexican Water Treaty, Water transfer, Mexico, Pumping plants, Reservoir storage, Electric power demand, Radio communications systems, Transmission(Electrical), Electric power rates.
Identifiers: Solar salt operations.

Flow through the Colorado River Aqueduct, California, averaged 1655 cfs or an output of 7-8 pumps. In February flow was reduced for Lake Skinner inlet maintenance and preventing Lake Mathews storage from exceeding the winter maximum. Emergency diversion of Mexican Treaty water through the aqueduct to Tijuana continued; Mexico paid $584,774 for 8702 acre-feet of water. Preventive maintenance of pumps and control equipment was performed. Security gates were installed and fencing extended. Aqueduct maintenance included repairing drainage ditches, fences, roads, and buildings; cleaning sandtraps and trash racks; chemically retarding algae, mechanically removing algae, and cultivating tamarish trees for sand drift control. Solar salt operations were conducted at Danby Dry Lake. The radio communication system included 189 mobile and portable units and 12 base stations. The pumping load required purchase of 2,430,204,365 kwh during the year. A total of 1,476,224,580 kwh of Hoover and Parker energy was purchased to pump 727,500 acre-feet of Colorado River Water. Edison provided standby electric generating capacity. The electric energy rate for offpeak power purchased from Edison increased from 8.506 to 16.688 mills/kwh. Non-firm energy from the Bureau of Reclamation Glen Canyon Power Plant was purchased in lieu of Edison energy at 22% savings. (See also W76-03285) (Buchanan-Davidson--Wisconsin)
W76-03286

DISTRIBUTION SYSTEM OPERATION AND MAINTENANCE.
In: The Metropolitan Water District of Southern California report for the fiscal year July 1, 1973 to June 30, 1974, p 11-31, 2 fig, 7 tab.

Descriptors: *Met. Water Dist. of So. Cal., *Distribution systems, *Operation and maintenance, *Colorado River, *California, Tunnels, Canals, Pipelines, Reservoirs, Treatment facilities, Domestic water, Municipal water, Agriculture, Groundwater recharge, Saline water barriers, Algae control, Water rates, Chlorine, Repairing, Cleaning, Conduits, Water delivery, Water distribution(Applied).

The distribution system for conveying Colorado River and State Project water consisted of over 600 miles of tunnels, canals, and pipelines; nine reservoirs; three treatment plants; and numerous regulating structures for delivery of wholesale water for domestic, municipal, agricultural, and groundwater replenishment purposes and for injection underground for sea water barrier projects. Water sales totaled 1,248,287 acre-feet. A Chemical Unloading Facility for chlorine transfer was completed in April 1974, near the Val Verde Tunnel. The San Joaquin Reservoir was repaired and the San Jacinto Reservoir prepared for abandonment. Several reservoirs, feeders, and pipelines were temporarily shutdown or dewatered for repairs or cleaning. The distribution system was enlarged by activating new service connections to serve more consumers. Tables give descriptions of the distribution system conduits, their cost, and completion date. Monthly water deliveries for the fiscal year 1973-1974 and yearly figures for the past 33 years are given for untreated or softened and filtered Colorado River and State Project water. The price of water per acre-foot, water production of constituent areas of the Metropolitan Water District, and water used for underground replenishment are also shown. (See also W76-03285) (Buchanan-Davidson--Wisconsin).
W76-03287

WATER TREATMENT.
In: The Metropolitan Water District of Southern California report for the fiscal year July 1, 1973 to June 30, 1974, p 33-61, 7 fig, 10 tab.

Descriptors: *Met. Water Dist. of So. Cal., *Water treatment, *Colorado River Aqueduct, *California, Operation and maintenance, Algal control, Treatment facilities, Filtration, Water softening, Chlorination, Pilot plants, Methodology, Sludge disposal, Coliforms, Coagulation, Sampling, Ion exchange, Chemical properties, Reverse osmosis, Dissolved solids, Organic matter, Flow rates, Silicates, Cation exchange, Water quality, Corrosion, Taste, Odor, Repairing, Electric power, Water delivery, Hardness(Water).

Colorado River water from Lake Mathews was treated at the Weymouth Memorial Softening and Filtration Plant and Diemer Filtration Plant. State Project water from Castaic Lake was treated at the Jensen Filtration Plant. Chlorination, polyelectrolytes, and pH adjustments were used at each plant; plus coagulation at the Jensen plant and ion exchange softeners at the Weymouth plant. Reverse osmosis to reduce salinity was investigated. Membrane cleaning and feed water acidification and treatment with Calgon were used. Feed water pretreatment with a primary coagulant followed by filtration was effective in removing colloidal silicate minerals and organic matter. Plant operating processes were studied to develop improved treatment methods. Cationic polymers in multi-column filters gave better filtered water. A subsurface wash reduced mudball volumes. Fluid sludge was best dewatered with pressure filters. Water quality, corrosion, algal growth, taste, and odor problems were studied. Operation, maintenance, repair, modification, sludge disposal, and use of chemicals, power, and cation exchange are described. Table of agricultural water deliveries; chemical and bacteriological analyses; variations in hardness and total dissolved solids; and cation exchange softener operations and graphs of average rates of flow and chemical quality of water to treatment plants are included. (See also W76-03285) (Buchanan-Davidson--Wisconsin).
W76-03288

ENGINEERING.
In: The Metroplitan Water District of Southern California report for the fiscal year July 1, 1973 to June 30, 1974, p 63-77, 1 fig.

Descriptors: *Met. Water Dist. of So. Cal., *Engineering, *Distribution systems, *California, Water purification, Water storage, Tunnels, Pipelines, Reservoirs, Water distribution(Applied), Water delivery, Filtration, Projects, Water rates, Financing, Hydroelectric power, Design, Facilities, Economics, Water demand, Water treatment, Construction costs.
Identifiers: Feeder systems, Filtration plants.

The engineering activities of the Metropolitan Water District of Southern California include planning, design, and construction of water transportation facilities, purification, and storage facilities. A billion dollar expansion program includes the construction of 300 miles of tunnels and pipelines, two reservoirs, flow and pressure control facilities, water filtration plants, a headquarters building annex, and improvements to existing facilities. Current projects include planning and construction of the Foothill, Sepulveda, Inland, and Yorba Linda Feeder Systems; and the Joseph Jensen, Robert A. Skinner, and Riverside Filtration Plants. Environmental impact studies, inundation maps, feasibility studies to determine the hydroelectric power potential, surveillance of dams and reservoirs, test programs, engineering designs for ten new service connections, and worker's compensation insurance are discussed. Advanced planning was done to provide extended

lead time for construction of facilities required to furnish water needed to satisfy probable future demands and to solve financial and economic problems caused by changing conditions of demand for water and changing costs of operation, construction, and related activities. Water demands are analyzed and plans were made to improve water quality. Studies of water pricing, surcharge rates for water treatment, and construction cost monitoring were made. (See also W76-03285) (Buchanan-Davidson--Wisconsin)
W76-03289

STATE WATER PROJECT.
In: The Metropolitan Water District of Southern California report for the fiscal year July 1, 1973 to June 30, 1974, p 78-85, 1 tab.

Descriptors: *Met. Water Dist. of So. Cal., *Projects, *Water supply, *California, Financing, Contracts, Capital costs, Construction, Facilities, Pumping plants, Electric powerplants, Recreation facilities, Interest rates, Electric power demand, Pumping, Electric power costs, Electric power production.
Identifiers: *State Water Project(Calif).

The Metropolitan Water District of Southern California activities related to obtaining water from the State Water Project included administration of the water service contract, monitoring project construction and operations, and representing the district at meetings and legislative and administrative hearings. At the end of the fiscal year 76% ($2,306 billion) of the total estimated expenditures for capital costs of the 1985 State Water Project facilities excluding additional conservation facilities and the San Joaquin Master Drain had been spent. Construction on the project was reduced because the first phase had been completed. The District received 191,723 acre-feet of State Project water. Power for State Water Project pumping facilities comes from project power recovery plants, the Pacific Northwest, and California utilities. Alternate power sources are being sought because of anticipated higher rates after 1983. State project facilities were used for recreation by over 2.5 million visitor days. Water contact sports and fishing were predominant uses. The Antelope Valley bikeway was opened. Litigation on Amendment No. 12 of the Metropolitan's water service contract, contract negotiations, settled issues, payment procedures for State Water Project service, and existing and proposed water exchange contracts are discussed. Payments to the state are summarized. (See also W76-03285) (Buchanan-Davidson--Wisconsin).
W76-03290

CONSTRUCTION.
In: The Metropolitan Water District of Southern California report for the fiscal year July 1, 1973 to June 30, 1974, p 87-99, 2 tab.

Descriptors: *Water distribution(Applied), *Met. Water Dist. of So. Cal., *Construction, *Projects, *Costs, *Contracts, *California, Tunnels, Pipelines, Reservoir storage, Treatment facilities.

Construction costs, including construction materials, equipment, right-of-way, engineering, and administration, totaled $56,097,200 for the fiscal year. Included in this total is $906,100 for the cost of constructing service connections to provide service to member agencies and for modifications that were requested to existing District facilities for the convenience of others. The District will be reimbursed for these costs by the agencies requesting the work. Eleven construction contracts having a total value of $29,229,149 were awarded by the District's Board of Directors and 11 contracts with gross earnings totaling $39,367,930 were completed. At the end of the fiscal year, work was in progress under 17 construction contracts having a total value of $86,788,310. The feature of each contract, the contractor, contract starting date, contract cost, and status on June 30, 1974 are tabulated. (See also W76-03285) (Auen-Wisconsin).
W76-03291

HYDROGRAPHY.
In: The Metropolitan Water District of Southern California report for the fiscal year July 1, 1973 to June 30, 1974, p 101-115, 4 fig, 2 tab.

Descriptors: *Met. Water Dist. of So. Cal., *Hydrography, *Planning, *Institutions, *Water resources development, Engineering, California, Water quality control, Water storage, Water sources, Water rights, Colorado River Basin, Waste water treatment, Ecology, Environmental effects, Salinity, Reservoir storage, Rainfall, Regional development, Groundwater, Reservoirs, Projects, Cost repayment, Water supply, Water utilization, Water transfer.

Primary concerns of the hydrographic engineering division of the Metropolitan Water District of Southern California are quality and quantity of water available from the Colorado River, the State Water Project, and other possible sources. Activities discussed were those related to water rights for surface and underground water supplies; basin plans for water quality management, standards, and controls; regional resource planning; wastewater treatment and reuse plans; and ecological and environmental studies. Federal, state, and local reports related to water and land resource planning are reviewed. Activities of the California State Water Resources Control Board and the Regional Water Quality Control Boards which related to basin plans for water quality management were especially important. The Lake Skinner operating plan; Morris Reservoir studies; Central Arizona project; the proposed Lake Mead accumulative storage program; and the Colorado River Basin salinity control program, reservoir storage, water supply, utilization, and quality are described. An environmental impact report of the proposed construction of the Peripheral Canal as part of the State Water Project is discussed. Graphs show amounts of usable water storage in reservoirs, water quality, and the Los Angeles rainfall record. Data is given on the quality of Colorado River water at the Whitsett Intake Pumping Plant. (See also W76-03285) (Buchanan-Davidson--Wisconsin).
W76-03292

LEGAL.
In: The Metropolitan Water District of Southern California report for the fiscal year July 1, 1973 to June 30, 1974, p 117-139.

Descriptors: *Met. Water Dist of So. Cal., *Legal aspects, *California, Colorado River Basin, Legislation, Right-of-way, Nevada, Taxes, Financing, Environment, Federal government, Nuclear powerplants, Indian reservations, Income, Bond issues, State Governments, Planning, Contracts, Judicial decisions, Conjunctive use, Mexican Water Treaty, Cooling water.
Identifiers: Annexation, Condemnation.

The General Counsel provided the Board of Directors and officers of the Metropolitan Water District of Southern California with legal representation, advice, and opinions on legal matters. Annexations, taxation, revenue bonds, application and interpretation of environmental quality acts, groundwater management, land matters, and right of ways are discussed. All legislation introduced in the California legislature was examined by counsel to see what was of interest and concern to the district; recommendations were made concerning legislation which required policy determination. State measures which were enacted to become effective in 1975 are discussed. Federal legislation pertinent to the district is also examined. The progress, status, and results of various cases which were in litigation in California, Nevada, and the federal courts are presented. Agreements involved in the supply of Colorado River water for proposed nuclear power plants are described. The claim of the Mohave Indians filed in 1951 against the Indian Claims Commission for loss of Mohave Reservation lands caused by construction, operation, and maintenance of Parker Dam is still pending. (See also W76-03285) (Buchanan-Davidson--Wisconsin).
W76-03293

PURCHASING, PERSONNEL, AND RIGHT OF WAY.
In: The Metropolitan Water District of Southern California report for the fiscal year July 1, 1973 to June 30, 1974, p 141-145.

Descriptors: *Met. Water Dist. of So. Cal., *Operation and maintenance, *Costs, Personnel, *California, Right-of-way, Employee relations, Water treatment, Equipment, Land, Leases, Rent, Taxes, Water districts.
Identifiers: Land acquisition, Surplus land disposal, Annexation.

In addition to the purchase of large items under formal contracts, the Metropolitan Water District of Southern California spent $6,602,056 for the year on purchase orders for materials, equipment, and services necessary for operation, maintenance, and new construction. There wre 1489 employees, of which 90 were temporary. Several seminars were held for management employees, supervisors, and foreman. Negotiations for acquisition of rights of way necessary for the constructions of new facilities or expansion and protection of existing facilities were continued. Property acquisitions were made for feeder pipelines, a tunnel, a desalting project and a utility corridor and electrical switchyard site required for the desalting project. Disposal of surplus properties and requests for easements, consents, permits, and licenses were also processed. Secondary usage of the District's right-of-way for recreation and environmental enhancement was considered. Finances involved in the leasing of property, property taxes, and assessments on property were handled. Several annexation changes were made, a report on boundary changes prepared, and information on taxable property submitted to county auditors. (See also W76-03285) (Buchanan-Davidson--Wisconsin).
W76-03294

FINANCING.
In: The Metropolitan Water District of Southern California report for the fiscal year July 1, 1973 to June 30, 1974, p 147-171, 14 tab.

Descriptors: *Met. Water Dist. of So. Cal., *Financing, *California, Income, Water rates, Operating costs, Operation and maintenance, Repairing, Principal, Interest, Bond issues, Taxes, Contracts, Water districts, Net income, Investment, Equity, Capital, Debt, Assessments.
Identifiers: Annexation.

The Metropolitan Water District of Southern California Board of Directors fixes water rates to produce revenue to pay operating expenses, provide repairs and maintenance, purchase or charge for property, services, and other rights; and pay interest and principal of bonded debts. District-wide ad valorem taxes can be levied for bond service and payment of obligations from water supply contracts with California. Ad valorem property tax levies are also authorized for general purposes. The board can determine conditions for annexation and issue bonds. For the fiscal year water sales revenues were $65,009,000 for 1,256,900 acre-feet of water delivered. Investment income was $12,050,000, time deposits and security investments $146,814,000, and operating expenses $50,398,000. There was a net loss of $2,449,000; tax levies are not considered income but as contributions to equity. Capital investment was

$55,722,665, tax levies $56,087,556, total assessed property valuation $32,839,617,218; and district property taxes $45,963,910. Annexation fees may be paid in cash at time of annexation or amortized over a 30-year period. There was a net increase in equity of $46 million. The fund balance was $147,621,785 on June 30, 1974. The total net direct and overlapping bonded debt was 11.50% of the 1973-74 assessed valuation of $32,836,859,113. (See also W76-03285) (Buchanan-Davidson--Wisconsin).
W76-03295

DEVELOPMENTS IN PUMPING SYSTEM, A TWO YEARLY REVIEW, PUMPING AND THE EMPINGHAM SCHEME.
For primary bibliographic entry see Field 8C.
W76-03340

LAND-USE CHANGE AND THE WATER BALANCE--AN EXAMPLE OF AN EVAPOTRANSPIRATION SIMULATION MODEL,
Otago Univ., Dunedin (New Zealand). Dept. of Geography.
For primary bibliographic entry see Field 2D.
W76-03359

AN ESTIMATE OF TOTAL SURFACE AREA OF VEGETATION FOR PUKEITI CATCHMENT, NORTHLAND, NEW ZEALAND,
Ministry of Works and Development, Nelson (New Zealand).
For primary bibliographic entry see Field 4D.
W76-03360

DYNAMIC SIMULATION OF WATER STORAGE IN FALLOW SOIL AS AFFECTED BY MULCH OF HYDROPHOBIC AGGREGATES,
Texas A and M. Univ., College Station. Dept. of Soil and Crop Sciences; and Texas Agricultural Experiment Station, College Station.
For primary bibliographic entry see Field 2G.
W76-03365

RELATIONSHIPS BETWEEN THE HYDRAULIC CONDUCTANCE OF SURFACE CRUSTS AND SOIL MANAGEMENT IN A TYPIC HAPLUDALF,
Soil Survey Inst., Wageningen (Netherlands).
For primary bibliographic entry see Field 2G.
W76-03366

LEVEE SYSTEM RELIABILITY ALONG A CONFLUENCE REACH,
Eotovs Lorand Univ., Budapest (Hungary). Dept. of Numerical Methods.
For primary bibliographic entry see Field 8B.
W76-03383

ALLOMETRIC CHANGE OF LANDFORMS,
Arizona Univ., Tucson. Dept. of Geosciences.
W. B. Bull.
Geological Society of America Bulletin, Vol 86, No 11, p 1489-1498, November 1975. 9 fig, 3 tab, 48 ref.

Descriptors: *Land forming, *Geomorphology, *Slopes, *Drainage, *Channel morphology, Sediment yield, Streams, Discharge(Water), Hydraulics, Pleistocene epoch, Model studies, Rivers, Waves(Water), Ponds.
Identifiers: *Allometric change, Steady state, Fluvial processes.

Allometric analysis has been used with considerable success to describe adjustment of streams and the model appeared to have promise for describing the interrelations between materials, processes, and landforms for a broad spectrum of geomorphic settings. Allometric adjustment can be shown to exist by demonstrating consistent and statistically significant interrelations between two or more geomorphic features of an open system. Allometric analysis can be used to describe the dynamic interrelations of aspects of a landform or process at different times during its history. The model applied to those landforms and processes that do, and those that do not, tend toward steady state. (Bhowmik-ISWS)
W76-03384

HURRICANE AGNES RAINFALL AND FLOODS, JUNE-JULY 1972,
Geological Survey, Reston, Va; and National Weather Service, Silver Spring, Md.
For primary bibliographic entry see Field 2E.
W76-03397

HYDROLOGY OF THE SOUTH PLATTE RIVER VALLEY, NORTHEASTERN COLORADO,
Geological Survey, Denver, Colo.
For primary bibliographic entry see Field 4B.
W76-03398

WATER RESOURCES OF WEST-CENTRAL MISSOURI,
Geological Survey, Rollo, Mo.
For primary bibliographic entry see Field 7C.
W76-03401

THE CHANNELS AND WATERS OF THE UPPER SALMON RIVER AREA, IDAHO,
Geological Survey, Boise, Idaho.
For primary bibliographic entry see Field 2E.
W76-03405

TECHNIQUES FOR WATER DEMAND ANALYSIS AND FORECASTING: PUERTO RICO, A CASE STUDY,
Geological Survey, Reston, Va.
For primary bibliographic entry see Field 6D.
W76-03407

GUIDELINES FOR FLASH FLOOD AND SMALL TRIBUTARY FLOOD PREDICTION,
National Weather Service Forecast Office, Washington, D.C.
L. A. Huges, and L. L. Longsdorf.
Available from the National Technical Information Service, U.S. Dept. of Commerce, Sills Building 5285 Port Royal Road, Springfield, VA 22161. NOAA Technical Memorandum NWS CR-58, October 1975, 13 p.

Descriptors: Floods, *Flood forecasting, *Flood control, *Flash floods, *Forecasting, Flood profiles, Rainfall, Rain, River basins, Storms, Streamflow, Weather forecasting, Thunderstorms.
Identifiers: *Tributary floods, Flood potentials, *Heavy rainfall, Flood indices, *Flood predictions, Basin flooding, Rainfall measurement, Radar estimates, Flood potential.

This technical note, augmenting Manual Chapter E-13, was devised to provide all offices with guidelines for determining the threat and extent of flash floods and other small tributary floods. Basically these involve knowledge of when, how much and how fast rain came down and over how much of a particular river basin, and some method for coverting this to river stage or flood potential. This report discusses these two points. Offices with a radar or a WBRR recorder play a key role in such effort as they have knowledge of the extent and location of heavy rain that other offices, at times, do not have. This paper starts with anticipating and locating heavy rain areas. Then extent of the flood will be estimated, with increased precision and objectivity, depending on how much specific information is available for the purpose, be it nothing but experience or the maximum consisting of flood indices and advisory tables. (NOAA)
W76-03417

REPORT ON ENVIRONMENTAL STUDY INTO THOMSON DAM AND ASSOCIATED WORKS.
Melbourne and Metropolitan Board of Works (Australia).
For primary bibliographic entry see Field 6G.
W76-03448

CHANGE IN YIELD OF WATER FOLLOWING A BUSHFIRE IN A FOREST OF EUCALYPTUS REGNANS,
Melbourne and Metropolitan Board of Works (Australia).
For primary bibliographic entry see Field 4C.
W76-03449

FLOOD PLAIN INFORMATION: PETERS CREEK, BIRCHWOOD, ALASKA.
Army Engineer District, Anchorage, Alaska.
Prepared for the Greater Anchorage Area Borough, Anchorage, Alaska, May, 1974. 27 p, 12 fig, 14 plates, 2 tab.

Descriptors: *Floods, *Flood forecasting, *Flood profiles, *Flood plains, *Flood data, Flood flow, Erosion, Peak discharge, Stream erosion, Glaciation, Warning systems, Flood peak, Obstruction, *Alaska.
Identifiers: Birchwood(Alaska), Anchorage(Alaska), Peters Creek(Alaska), Knik Arm Creek(Alaska), Standard Project Flood, Intermediate Regional Flood.

Though there is little historical flood data available for this 5.5 mile portion of Peters Creek, statistical analyses of streams in the region establish that Intermediate Regional Flood will occur reaching a height of 74.6 ft with peak flow of 4100 cubic feet/second, velocities of main channel flow of 7 to 14 ft/sec and overbank flows averaging 2 to 4 ft/sec. A Standard Project Flood will have a peak discharge of 8600 cfs and reach a height of 81.1 ft. In August, 1971, heavy rains caused flooding which reached a height of 71.6 ft at the gage located .8 mile from its confluence with Knik Arm. Since the area has minor residential development, damage was limited, displacing some 35 families, washing out roads and utilities. Future flooding can be expected to cause more damage since the area is absorbing residential overflow from Anchorage. This reach of Peters Creek, with a drainage area of 262.1 sq miles and a slope of 180 ft/mile, is crossed by 5 bridges and has heavy bank vegetation capable of obstructing flood flow. There are no flood control measures in effect but a flood warning system does exist. Flooding can occur in spring, summer or fall, resulting from snowmelt, glaciation, and storm fronts. (Henley-North Carolina)
W76-03454

FLOOD PLAIN INFORMATION: SOUTHEAST STREAM GROUP, STOCKTON, CALIFORNIA.
Army Engineer District, Sacramento , Calif.
Prepared for San Joaquin County, California, June, 1974. 53 p, 22 fig, 29 plates, 10 tab.

Descriptors: *Floods, *Flooding, *Flood data, *Flood recurrence interval, *Maximum probable flood, Historic floods, Flood damage, Flood profile, Flood forecasting, Flood frequency, *California.
Identifiers: Stockton(Calif), San Joaquin County(Calif), Littlejohns Creek(Calif), Duck Creek(Calif), Lone Tree Creek(Calif), Intermediate Regional Flood(IRF), Standard Project Flood(SPF).

The second of four reports intended to cover the entire greater Stockton area, this study discusses the southeast sector from State Highway easterly to the foothill line, and from the Calaveras River drainage on the north to the Stanislaus River

drainage on the south. Development in the area is approximately 94% agricultural and trends indicate minimal deviation. Population projections estimate an increase in population of 3,500 to 10,000 by the year 2000. Of the three creeks under study, Duck, Littlejohn, and Lone Tree, Littlejohns is the major creek. Two facilities provide flood protection: the Farmington Dam project, completed in 1951, which consists of Farmington Dam and Reservoir and the Duck Creek Diversion to Littlejohns Creek, and the improvement of Duck Creek channel completed in 1967. These two facilities provide protection against floods expected to occur once in 25-35 years or once in 10-15 years if there are flows through the Duck Creek Diversion. The largest flood occurred in 1958 with a peak discharge of 3,590 cfs, which inundated 2,000 agricultural acres. Future floods could be even larger than the 60-year frequency 1958 flood. The Intermediate Regional Flood (IRF) and the Standard Project Flood (SPF) would have peak discharges of 4,900 cfs and 5,100 cfs respectively at the Escalon-Bellota Road over Littlejohns Creek. Velocities could produce substantial erosion. (Park-North Carolina)
W76-03455

FLOOD PLAIN INFORMATION: WILDCAT CREEK, MANHATTAN, KANSAS.
Army Engineer District, Kansas City, Kans.
Prepared for the City of Manhattan, Kansas, through the Kansas Water Resources Board, December, 1971. 32 p, 12 fig, 9 plates, 3 tab.

Descriptors: *Flood control, *Flood protection, *Floods, *Flooding, *Flood profiles, Flood plains, Historic floods, Flood damage, *Kansas.
Identifiers: Wildcat Creek(Kansas), Manhattan(Kansas).

Originating 28 mi north of Manhattan, Wildcat Creek flows southeasterly along the city's western edge, entering the Kansas River south of the city. Its basin has a jagged oblong shape and a watershed of 88 sq mi. Channel width in the study reach averages 80 ft with a bottom slope of 12.5 ft/mi. Flood plain width is about 1,200 ft. In the upper basin runoff is from agricultural lands; in the lower basin runoff is influenced by development on the fringes of the city. Approximately 1.3 sq mi of the lower left bank area is within the Manhattan Protective Works with runoff discharged through a pumping plant. Extensive commercial, industrial and residential development is increasing on the flood plain which has most of the remaining vacant land. Projected population increase for Manhattan Urban Area is 14,000 by 1985. Floods created by heavy rainfall have high peaks, high velocities, short durations and relatively small volumes of runoff. No flood damage prevention program exists. The largest known flood in June 1965 had a peak discharge of 6,300 cfs. Since there are no gage records, precipitation and streamflow records of nearby basins were used to compute discharges for the Intermediate Regional Flood (IRF) and Standard Project Flood (SPF). An IRF would have a peak discharge of 13,800 cfs at Manhattan with average channel velocities of 10.2 ft/sec and 1.8 ft/sec overbank at the Union Pacific Railroad. Peak discharge for SPF would be 24,500 cfs with channel velocities of 10.9 ft/sec and 2.9 ft/sec overbank at the same location. At other points channel velocities for SPF can rise as much as 13.2 ft/sec with overbank velocity 5.4 ft/sec. peaking in about 14 hours and remaining out of banks for as much as 32 hours. (Salzman-North Carolina)
W76-03456

FLOOD PLAIN INFORMATION: ROARING BROOK, AVON, CONNECTICUT.
Army Engineer District, Waltham, Mass.
Town of Avon, Technical report. October 1966. 22 p, 13 fig, 2 tab, 10 plates.

Descriptors: *Floods, *Flooding, *Flood plains, *Flood profiles, Channel improvement, Flood damages, Non-structural alternatives, Flood plain zoning, Building codes, Flood peak, Storms, Hurricanes, Dams, Flood protection, Snowmelt, *Connecticut.
Identifiers: Roaring Brook(Cn), Avon(Cn), Secret Lake(Cn), Hartford County(Cn), Jim Brooks(Cn), Farmington River(Cn), Farmington(Cn), Canton(Cn), Manning's Friction Formula.

The study area extends from Secret Lake at the Avon - Canton town line along Roaring Brook to the Avon - Farmington town line, a distance of 4.4 miles. Located 3 miles west of the Avon business district, Roaring Brook, a tributary of Farmington River, drains an area of 9.8 square miles in Hartford County. The flat, wide flood plains are without industrial or commercial development and only a few homes have experienced flooding in the past. Residential development in the basin is occurring but to date has not been located in probable flood areas. Extended development on both sides of the stream is anticipated. Currently, Avon utilizes subdivision regulations to control development in the flood plain. Bridges and 3 dams can obstruct floodflows. Flood flows are effectively reduced by Secret Lake and a large swamp area immediately upstream from the study area. Average rainfall in adjacent Hartford is about 42.8 inches, annual average snowfall about 41.5 inches. Flooding can occur as the result of cyclonic continental storms, hurricanes, and thunderstorms and can be augmented by snowmelt. The flood of August, 1955, the most severe in recent history, had a peak discharge of 1,150 cubic feet per second and damaged homes along the eastern shore of Secret Lake. This flood had the characteristics of a 1-2% annual probability flood. Consideration of the following factors is recommended in the development of a general plan for guiding development: (1) effect of filling (2) flood losses (3) cost of protective measures (4) cost of floodproofing and (5) cost of insurance. (Henley-North Carolina)
W76-03457

FLOOD PLAIN INFORMATION: ESCONDIDO CREEK, SAN DIEGO COUNTY, CALIFORNIA.
Army Engineer District, Los Angeles, Calif.
Prepared for San Diego County, May, 1972. 34 p, 14 fig, 18 plates, 5 tab.

Descriptors: *Floods, *Floodwater, *Flooding, *Flood forecasting, *Flood profiles, *Stream erosion, *Flood plains, *Flood plain zoning, Streamflow forecasting, *California, Thunderstorms, Flood frequency, Peak discharge, Flood peak, Flow characteristics, Erosion, Obstructions to flow, Non-structural alternatives, Dikes.
Identifiers: Escondido Creek(Calif), La Orilla Road Tributary(Calif), Escondido(Calif), Lake Val Sereno(Calif), San Elijo Lagoon(Calif), Intermediate Regional Flood, Standard Project Flood, Debris-laden floods.

Land use along Escondido Creek from the Pacific Ocean to the City of Escondido has been primarily agricultural in the past and, except for the area around Lake Val Sereno at the upper study limit where some increase is expected in residential development, little change is anticipated. Portions of the flood plain of Escondido Creek and La Orilla Road Tributary (total drainage area 78 sq mi) are studied. General winter storms, local thunderstorms, and tropical hurricanes produce precipitation. High intensity rainfall, in combination with steep streambed gradients and effects of preceding fires, result in intense debris-laden floods. Though 6 large floods have occurred, since 1916 there are no streamflow records for Escondido Creek. Data from similar basins was used for flood projections. A flood in 1966 caused minor damage. In an Intermediate Regional Flood (IRF) peak flows of 22,000 cfs at the mouth of Escondido Creek are expected, accompanied by channel velocities of 5 to 10 ft/sec at various locations. A Standard Project Flood would produce a peak flow of 32,000 cfs at the mouth of the creek with channel velocities of up to 11 ft/sec. In the steep canyon section velocities would reach 24 ft/sec causing severe erosion. Damage due to flooding could include mobile homes, a sewage treatment plant and pumping station, residences, agricultural lands, and a golf course. Approximately one-half mile of earth dike channelizes Escondido Creek at the upstream end of the study area, but no other flood control projects exist. San Diego County is now rezoning those portions of the flood plain which would be affected by an IRF. (Smith-North Carolina)
W76-03458

FLOOD PLAIN INFORMATION: RILLITO RIVER AND PANTANO WASH, VICINITY OF TUCSON, ARIZONA.
Army Engineer District, Los Angeles, Calif.
Prepared for Pima County, June, 1973. 30 p, 23 fig, 20 plates, 6 tab. Preliminary designated floodway, Jan., 1974. 1 p, 7 plates.

Descriptors: *Flash flood, *Flood forecasting, *Flood profiles, *Peak discharge, *Erosion, *Bank erosion, *Flood plains, *Floodways, Floods, Flooding, Historic floods, Flow characteristics, Non-structural alternatives, Channel improvement, *Arizona.
Identifiers: *Rillito River(Ariz), *Pantano Wash(Ariz), *Designated floodway, Tucson(Ariz), Tanque Verde Creek(Ariz), Floodway fringe, Overbank limits.

Rillito River (drainage area 934 sq mi) is formed by the confluence of Pantano Wash and Tanque Verde Creek northwest of Tucson which has a population of more than 250,000 in the metropolitan area with continued urban expansion anticipated. Pantano Wash (drainage area 608 sq mi) rises in Santa Rita Mountains and flows north through alluvial plains to its confluence with Tanque Verde Creek. Mostly agricultural and undeveloped desert land, drainage area ranges from 9450 ft mean sea level in headwater regions to 2200 ft msl at downstream limit. Debris laden flash floods rise in the mountains, spread out over valley plains with reduced velocities, depositing debris and losing flow to streambed percolation. Pima County requires that new developments be protected against major stream flooding. Major floods (peak discharge over 12,000 cubic feet per second) have occurred at irregular intervals since 1880 with September, 1929 having largest discharge of 24,000 cfs. The December, 1965 flood (discharge 12,400 cfs) caused extensive damage in Tucson eroding banks and destroying homes, roads and sewer line. During an Intermediate Regional Flood (IRF), Rillito River would have a peak flow of 31,000 cfs, channel velocities would range from 9-12 ft/sec with 2 ft/sec overbank. Expected peak flow for a Standard Project Flood (SPF) would be 81,000 cfs, channel velocity 11-15 ft/sec, 3 ft/sec overbank. Pantano Wash would have a peak flow of 32,000 cfs, channel velocities from 10-14 ft/sec with 0-2 ft/sec overbank for an IRF; 61,000 cfs peak flow, channel velocities 10-14 ft/sec with 3-10 ft/sec overbank for an SPF. A preliminary designated floodway for Rillito River is appended. (Hufschmidt-North Carolina)
W76-03459

FLOOD PLAIN INFORMATION: BIG CREEK, LOST CREEK, CHRISTIAN CREEK AND WHITEMAN'S CREEK, JONESBORO, ARKANSAS.
Army Engineer District, Memphis, Tenn.
Prepared for the City of Jonesboro, March, 1971. 41 p, 10 fig, 18 plates, 16 tab.

Descriptors: *Flood profiles, *Floods, *Flooding, *Flood flow, *Flood forecasting, Maximum probable flood, Flood plains, Runoff, Peak discharge, Flood peak, Flow duration, Flow characteristics, Flood data, Flood frequency, Overflow, *Arkansas.

Identifiers: Jonesboro(Ark), Bid Creek(Ark), Lost Creek(Ark), Christian Creek(Ark), Whiteman's Creek(Ark), Standard Project Flood, Intermediate Regional Flood.

Jonesboro, located on the watershed divide between the St. Francis and Cache Rivers, has experienced flooding along the four creeks of this study area. In January, 1969, 4.73 inches of rain fell during a 24-hour period causing extensive flooding, especially along Whiteman's Creek and Lost Creek. High water marks during this flood were usually below the top of the banks, indicating that there is poor local drainage. Analysis indicates that the Intermediate Regional Flood (IRF) for Big Creek and Lost Creek would be about 2.5 feet overbank and 1.5 feet overbank on Christian Creek and Whiteman's Creek. 'Standard Project Flood (SPF) determinations indicate that floods would be about 1.7 feet higher than the IRF on Big Creek, Lost Creek, Christian Creek and Whiteman's Creek.' Water velocities during the IRF would range up to 8.2 ft/sec in the channel of Big Creek; to 5.2 ft/sec on Whiteman's Creek. Velocities on the flood plains would average less than 1.5 ft/sec. During the SPF, velocities would range from 11.8 ft/sec on Big Creek to 7.4 ft/sec on Lost Creek. Velocities on the flood plains during an SPF would range from 3.0 ft/sec on Whiteman's Creek to 1.8 ft/sec on Big Creek. These four creeks drain approximately 142 sq mi. The main flood season is winter and spring. Duration of flooding can be expected to be short and the rate of rise rapid. (Henley-North Carolina)
W76-03460

SPECIAL FLOOD HAZARD INFORMATION REPORT: BEAR CREEK, DENVER METROPOLITAN AREA.
Army Engineer District, Omaha, Nebr.
Prepared for Colorado Water Conservation Board, December, 1972. 17 p, 4 fig, 10 plates, 3 tab.

Descriptors: *Floods, *Flood forecasting, *Flood profiles, *Flood damage, *Flood plains, *Colorado, Floodwater, Flooding, Flash flood, Flood flow, Snowmelt, Historic floods, Flood data, Flood frequency, Peak discharge, Flow characteristics, Erosion, Bank erosion, Obstructions to flow, Flood protection, Warning systems, Erosion control, Channel improvement, Riprap.
Identifiers: Bear Creek(Colo), Turkey Creek(Colo), Morrison(Colo), Sheridan(Colo), Platte River(Colo), Denver(Colo), Intermediate Regional Flood, Standard Project Flood.

Land use in this study area, which extends 7.5 miles from the mouth of Bear Creek to about 1.8 mi upstream from South Kipling Street, is about 12% commercial, 24% residential, 9% transportation, 4% public property and the balance in various uses. In 1970, 6050 people lived in the Bear Creek flood plain and greater development is expected. Bear Creek drains 261 square miles, the basin being 36 miles long and 13 miles wide at its maximum. Turkey Creek, draining 52 sq mi, joins Bear Creek 2 mi downstream from Morrison. Bear Creek flows into the South Platte River in the southern Denver Metropolitan Area and has a capacity of 2500 cubic feet per second without causing flooding. Flood records since 1927 at Sheridan and periodically since 1888 at Morrison indicate that high peak discharges occurred in 1933 and 1969. The 1933 event was gaged at 8110 cfs at Morrison and 3000 cfs at Sheridan, whereas the 1969 flood was measured at 8150 cfs at Sheridan and 2340 cfs at Morrison indicating that past recorded floods have occurred either above or below Morrison but never in both drainage areas at the same time. For an Intermediate Regional Flood a peak discharge of 30,000 cfs is predicted with water velocities of 7 feet per second. A large flood would last 12 hours, though steady rains combined with snowmelt runoff could result in high flows for 30 days or more causing severe erosion. A Standard Project Flood would have a peak discharge of 76,500 cfs and inundate a large shopping center, many homes and several large mobile home parks. River stage forecasts for Bear Creek are made by the Weather Service to warn of flash flooding with flood crests anticipated about 6 hours after lead time. (Smith-North Carolina)
W76-03461

FLOOD PLAIN INFORMATION: CACHE LA POUDRE RIVER, COLORADO, VOLUME II, GREELEY, WELD COUNTY.
Corps of Engineers, Omaha, Nebr.
Prepared for Larimer-Weld Planning Commission, March 1974. 30 p, 12 plates, 19 fig, 5 tab.

Descriptors: *Flood plains, *Flood data, *Flood profiles, *Flood forecasting, *Flow characteristics, Snowmelt, Runoff, Flood plain zoning, Reservoirs, Storms, Historic floods, Peak discharge, Flow duration, Flood damage, *Colorado.
Identifiers: Cache La Poudre River(Co), South Platte River(Co), Greeley(Co), Weld County(Co), Larimer County(Co), Standard Project Flood, Intermediate Regional Flood.

This 14.8 mile study reach of the Cache La Poudre River, a tributary of South Platte River, extends from the mouth near Greeley to about a mile above Sheep Draw and drains an area of 1,890 square miles. The river has a slope of 6.6 ft./mile in this reach, with flood plain widths ranging from 3,500 to 4,000 ft. largely without urban development, although a large number of buildings are located in the flood plain on the northeast side of Greeley. In Greeley the flood plain is moderately developed. Fourteen bridges, roadways and vegetation can obstruct flood flows. Continued growth in Greeley (1970 population 38,902, projected 1990 population 75,000) is expected to exert further development pressure on the flood plain. Greeley presently has zoning ordinances which restrict development within an area less than 200 ft. from the centerline of the river. Flooding can occur from May to September as the result of intense rainfall. Snowmelt can augment floodflows in May, June and July. Typically, floods will peak within 4 days of an intense rainfall and will last several days. Flooding in June 1965 with a peak discharge of 3,480 cubic feet per second did $700,000 damage to rural areas in the Poudre basin and $85,000 damage in the vicinity of Greeley. Standard Project Flood and the Intermediate Regional Flood will have peak discharge of 29,000 and 9,000 cfs respectively at the 25th Ave. bridge. (Henley-North Carolina)
W76-03462

4B. Groundwater Management

ECONOMIC EFFECTS OF LAND SUBSIDENCE DUE TO EXCESSIVE GROUNDWATER WITHDRAWAL IN THE TEXAS GULF COAST AREA,
Texas A and M Univ., College Station. Water Resources Inst.
L. L. Jones, and J. Larson.
Available from the National Technical Information Service, Springfield, Va 22161, as PB-248 454, $4.00 in paper copy, $2.25 in microfiche. Technical Report No 67, September 1975, 33 p, 2 fig, 8 tab, 7 ref. OWRT A-032/TEX (1). 14-31-0001-5044. 14-34-0001-6045.

Descriptors: *Land subsidence, *Groundwater, *Withdrawal, Evaluation, Costs, *Texas, *Economic impact, Water demand, Cost comparison, Estimating.
Identifiers: Houston(Tex), Baytown(Tex), Pasadena(Tex), LaPorte(Tex), Seabrook(Tex), Clear Lake(Tex), Kemah(Tex), Texas Gulf Coast area, *Galveston Bay area.

The Texas Gulf Coast area is experiencing subsidence of the land surface due to excessive withdrawals of groundwater. Damages and property losses are significant, especially along the upper Galveston bay are, including Houston, Baytown, Clear Lake City and other developments. This study estimates total annual damages and losses for a 945 square mile study area to be $31.7 million. Temporary flooding, permanent inundation, bulkheading and landfilling were the major subsidence-related causes of cost and/or losses in property value. Structural damages from subsidence aggrevated faults were also significant. Damages and losses were more intensive in areas adjacent to Galveston Bay and major waterways. Breakeven analysis implies economic justification for withdrawing only that quantity of water that would result in no subsidence. Water needs above that rate should be imported to minimize total costs to the area. Importation of up to 198 billion gallons per year would be justified to meed demand and avoid subsidence. At current water use rates and prices of surface and groundwater, the area could save as much as $11.4 million annually, even if all water needs were met from surface sources.
W76-03099

AQUIFER EVALUATION USING DEPOSITIONAL SYSTEMS: AN EXAMPLES IN NORTH-CENTRAL TEXAS,
Dames and Moore, Boca Raton, Fla.
For primary bibliographic entry see Field 2F.
W76-03111

SOUTH PLATTE RIVER FLOW CORRELATIONS,
Colorado State Univ., Fort Collins. Dept. of Civil Engineering.
R. E. Glover.
Journal of the Irrigation and Drainage Division, American Society of Civil Engineers, Vol 101, No. IR3, Proceedings Paper 11563, p 175-186, September 1975. 3 fig, 3 tab, 15 ref, 2 append.

Descriptors: *Water management(Applied), *Water resources development, *Conjunctive use, *Optimum development plans, *Surface-groundwater relationships, Withdrawal, Diversion, Pumping, Prior appropriation, Water allocation(Policy), Water supply, Flow characteristics, Groundwater, Hydrology, Irrigation, Return flow, Streamflow, *Colorado.
Identifiers: *South Platte River(Colo).

Administration of water resource management legislation on the South Platte River has been hindered by the lack of knowledge of surface water-groundwater relationships. Effective management of appropriation by surface diversion and groundwater pumping requires some advance knowledge of quantitative effects of polity decisions. A computation method for evaluating these effects was developed and applied to the South Platte; comparison of computed results to past performance of the River supported the method. Major computations were reduced to tabular form for ease of application. The effect of pumping in the valley was determined by the method to be depletion of the river flow by approximately one-fifth the yield of the watershed. Since the response of river flow to variation in pumping is demonstrably slow, it is futile to include wells in the priority allocations scheme; yet the surface and groundwaters of the South Platte valley must be considered a single water supply, because no acceptable river flow correlations can be obtained while return flows of groundwater to the river are excluded. (Bender-ISWS)
W76-03117

DETERMINING OPTIMAL WELL DISCHARGE,
Colorado State Univ., Fort Collins.
O. J. Helweg.
Journal of the Irrigation and Drainage Division, American Society of Civil Engineers, Vol 101, No IR3, Proceedings Paper 11566, p 201-208, September 1975. 5 fig, 6 ref, 3 append.

Descriptors: *Cost-benefit ration, *Discharge(Water), *Water wells, Drainage, Costs, Economics, Geohydrologic units, Groundwater, Water table, Irrigation, Optimization, Pumping, Water resources, Water supply, Wells, Well spacing, Water yield.
Identifiers: *Well yield, *Well loss, *Optimum use.

The cost of pumping groundwater is a major factor in water supply. It is necessary to pump a given well at the discharge that maximizes the net benefit of the operation. Previous criteria ignored the economic aspects of the analysis; a detailed criterion for obtaining the best discharge for a well was submitted. A real world example showed the importance of considering well losses in any analysis. A computer code is included along with an example of the analysis. (Visocky-ISMS)
W76-03118

ENERGY DISSIPATOR AIDS FIGHT AGAINST HIGH PRESSURE PROBLEMS.
Water and Sewage Works, Vol 5, No 2, p 76-77, September, 1975. 2 fig.

Descriptors: *Energy dissipation, *Water pressure, *Cavitation, *Equipment, Water rates, Water supply, Costs, Aqueducts, Wells, Environmental effects, *California.
Identifiers: *Energy dissipator.

Because of environmental considerations it became necessary for wells in California's San Bernardino mountain region to be closed and for water to be drawn for this region from the Feather River aqueduct that traverses the coastal mountain chain. Because of pressures as high as 172 ft/sec, severe cavitation problems were involved in transporting the aqueduct water. An energy dissipator was developed to deal with these problems, comprising tubes of varying length filled with furnace welded steel balls and placed inside a water main. Cavitation was able to occur within the dissipator and blockage was efficiently cleared out from it with no damage to the unit. The water agency which services the San Bernardino mountain area has equipped each of its 27 turnouts with an energy dissipator. This increased its water costs; it must charge $250/acre ft, as compared to $70/acre foot charged by valley agencies. However, because environmental considerations are so compelling, and because of health department actions against wells, about 6% more customers per year are using the water from the Feather River Aqueduct. The new energy dissipator permits this water to be distributed safely and efficiently. (Beale-FIRL)
W76-03212

PRIVATE CONSTRAINTS ON GROUNDWATER CONTAMINATION,
Virginia Polytechnic Inst. and State Univ., Blacksburg. Water Resources Research Center.
W. R. Walker, and W. E. Cox.
Journal of the Hydraulics Division Proceedings of ASCE, Vol 101, No HY10, p 1333-1341, October, 1975. 29 refs.

Descriptors: *Groundwater, *Water rights, *Water quality control, *Water pollution control, Hydrologic aspects, Legal aspects, Water pollution sources, Water supply.

While water rights have been supplemented by direct governmental controls in the case of surface waters, protection of groundwater quality has been inadequate. Various judicial decisions regarding the rights of a groundwater user to an uncontaminated water supply are presented. The interpretations of court cases showed no clear patterns of legal action. In many cases, potential sources of groundwater pollution are essentially unregulated, and in cases where penalties for groundwater contamination do exist, there is no means for assuring recovery of losses. A 1970 survey indicated that groundwater constituted about one-third of public water supplies and provided about 95% of water used by 41 million people served by private domestic systems in the United States. It was strongly recommended that more comprehensive and effective controls are needed to supplement the mechanism of water rights and to protect the domestic water supplies. (Kramer-FIRL)
W76-03244

ECONOMIC ASPECTS OF GEOELECTRICAL PROSPECTING IN SANDSTONE AQUIFERS,
Birmingham Univ. (England). Dept. of Geological Sciences.
P. F. Worthington.
Water Services (G.B.), p 181-183, May 1975. 2 ref.

Descriptors: *Aquifers, *Exploration, *Resistivity, *Hydrogeology, Surveys, Sandstones, Europe, Aquifer characteristics, Mapping, Cost comparisons, Water quality, Boreholes.
Identifiers: England.

A frequent claim is made that the application of geophysical methods in hydrogeological studies can result in large monetary savings. These claims are particularly substantiated in cases of geoelectrical investigations of water-saturated sands and sandstones. This contribution indicates quantitatively the savings that can be made if geoelectrical methods are used in hydrological investigations of a consolidated sandstone aquifer. It is shown that savings can be made through a more rapid delineation of the aquifer boundaries, greater precision in mapping variations in aquifer thickness and therefore, to some extent, transmissivity, and a more reliable determination of zones of good water quality. In consequence, there are decided reductions in drilling and water treatment costs. The basic data presented are based on experience gained during a six-year hydrogeophysical survey of the Bunter Sandstone of Northwest Lancashire, England. It is demonstrated that the geoelectrical delineation of aquifer boundaries can be achieved with drastic savings over the alternative use of trial boreholes, provided that workable resistivity contrasts exist between different formations. (Carpenter-Wisconsin)
W76-03276

THE USE OF A DIGITAL MODEL IN THE MANAGEMENT OF THE CHALK AQUIFER IN THE SOUTH DOWNS, ENGLAND,
Department of the Environment, Reading (England). Central Water Planning Unit.
D. A. Nutbrown, R. A. Downing, and R. A. Monkhouse.
Journal of Hydrology, Vol 27, No 1/2, p 127-142, October 1975. 8 fig, 1 tab, 7 ref.

Descriptors: *Groundwater movement, *Aquifer management, *Safe yield, *Saline water intrusion, *Computer models, Subsurface waters, Groundwater recharge, Groundwater availability, Drawdown, Natural recharge, Water resources development, Aquifers, Model studies, Mathematical models, Infiltration.
Identifiers: *Chalk aquifers, *South Downs(England), Optimum yield.

A digital model was used to describe the transient effects of natural infiltration and abstraction on the movement of groundwater, and as a tool to assist with the long-term management of the Chalk aquifer of the South Downs. The primary aim of the study was to estimate the maximum yield of the aquifer, including saline intrusion, both from the sea and from tidal rivers. After the model had been calibrated, several experiments were performed with reference to the long-term development and operation of the aquifer. Abstraction regimes, designed to maximize final storage in the aquifer, were generated automatically by the model, using a dynamic programming approach. Under conventional methods of development, the conditions likely to prevail at the limit of development, particularly at the end of an extended period of limited infiltration, were investigated and their influence on future management proposals considered. The possibility of extending the development limit by means of artificial recharge was also studied using the model. (Prickett-ISWS)
W76-03356

A SUMMARY OF THE BIOGEOCHEMISTRY OF NITROGEN COMPOUNDS IN GROUND WATER,
California State Univ., Chico.
For primary bibliographic entry see Field 5B.
W76-03358

APPLICATIONS OF ELECTRO-OSMOSIS TO GROUND-WATER FLOW PROBLEMS,
University Coll. of Swansea (Wales). Dept. of Civil Engineering.
For primary bibliographic entry see Field 2F.
W76-03362

C. E. JACOB'S STUDY ON THE PROSPECTIVE AND HYPOTHETICAL FUTURE OF THE MINING OF THE GROUND WATER DEPOSITED UNDER THE SOUTHERN HIGH PLAINS OF TEXAS AND NEW MEXICO,
New Mexico Inst. of Mining and Technology, Socorro.
W. Brutsaert, G. W. Gross, and R. M. McGehee.
Ground Water, Vol 13, No 6, p 492-505, November-December 1975. 16 fig.

Descriptors: *Groundwater mining, *Alluvial aquifers, *Aquifer systems, *Groundwater movement, *Groundwater recharge, *New Mexico, *Terms, Steady flow, Unsteady flow, Storage, Hydraulic conductivity, Specific yield, Hydrology.
Identifiers: *Ogallala aquifer.

From 1965 until his death in 1970, Professor C. E. Jacob was chariman of Ground-Water Hydrology at New Mexico Institute of Mining and Technology. During the last three decades, groundwater studies have advance considerably due to his efforts, original achievements, and philosophies. He is considered one of the founders of modern groundwater hydrology. In this study, taken from unpublished reports and notes, Jacob projects the decline of the water table in the Ogallala aquifer of the Southern High Plains of New Mexico and Texas. After developing approximate analytical solutions for steady and unsteady flow as a function of flow depth, slope, water-table configuration, and recharge, numerical results were obtained by digital computation. Representative values of porosity and hydraulic conductivity, required for this purpose, were obtained from an analysis of well data. Jacob concluded that the hypothetical time required for draining the aquifer, without pumping and without recharge, is from 5000 to 8000 years. At pumping rates prevailing during the decade 1951-1960, with natural recharge and discharge operating, the aquifer will be depleted in less than 100 years. Starting with complete exhaustion, the aquifer would recover to within 2% of initial (1938) storage in 5600 to 5700 years. If pumpage had ceased at the end of 1958, recovery to within 2% initial storage would probably not exceed 1500 years. These estimates assume that no local or temporary climatic fluctuations of the water table take place during the time spans considered. (Gibb-ISWS)
W76-03363

HEXAVALENT CHROMIUM IN THE GROUND WATER IN PARADISE VALLEY, ARIZONA,
Delaware Univ., Newark. Water Resources Center.
F. N. Robertson.
Ground Water, Vol 13, No 6, p 516-527, November-December 1975. 7 fig, 1 tab, 29 ref.

Descriptors: *Water chemistry, *Groundwater, *Alluvial aquifers, *Arizona, *Chromium, Hydrogen ion concentration, Oxidation-reduction potential, Water quality, On-site investigations, Sampling, Analysis, Pollutants, Water pollution sources.
Identifiers: *Paradise Valley(Ariz), *Hexavalent chromium.

Hexavalent chromium, Cr(+6), of natural origin has been found in the groundwater in Paradise Valley, Maricopa County, Arizona. The concentrations exceed 0.05 mg/l, the U. S. Public Health Service's upper limit for Cr(+6). Paradise Valley is a northwest-trending, down-faulted basin of about 225 sq mi, located in the semi-arid Basin and Range physiographic province. The accumulation of fine-grained sediments (in part gypsiferous) near the center of the basin indicateds that the material was deposited in a playa-type sedimentary environment. The Cr(+6) is present in the groundwater in a 75-sq mi area and forms an elongate northwest-trending pattern in the southern part of the basin. The largest Cr(+6) concentrations are located in the approximate center of this pattern and decrease toward the margins. The Cr(+6) distribution in the groundwater corresponds to the location of the fine-grained part of the alluvial deposits; the highest Cr(+6) concentrations are associated with the finest-grained sediments. Evidence indicates that the Cr(+6) is fairly evenly distributed vertically in the groundwater, at least throughout the finer-grained part of the aquifer system. Thermodynamic calculations and Eh and pH measurements of the groundwater indicate that the water containing Cr(+6) is oxidizing and alkaline enough to account for the observed concentrations. An alkaline environment, largely a result of primary silicate hydrolysis in the fine-grained sediments, allows chemical oxidation of the trivalent chromium to the soluble Cr(+6). (Gibb-ISWS)
W76-03364

PULSE-TESTING RESPONSE FOR UNEQUAL PULSE AND SHUT-IN PERIODS,
Amoco Production Co. Tulsa, Okla.
M. Kamal, and W. E. Brigham.
Society of Petroleum Engineers Journal Vol 15, No 5, p 399-410, October 1975. 16 fig, 11 ref, 1 append.

Descriptors: *Oil reservoirs, *Pumping, *Drawdown, *Confined water, Mathematics, Unsteady flow, Wells, Equations, Aquifer characteristics, Groundwater, Aquifer testing, Aquifers, Testing, Reservoirs, Mathematical studies, Test wells, Pressure head, Water pressure, Computer programs.
Identifiers: *Pressure response, *Cyclic pumpage, Dimensionless curves, *Pulse testing.

A theoretical study was carried out to develop the general equations relating time lags and response amplitudes to the length of the pulse cycles and the pulse ratios of these cycles for pulse tests with unequal pulse and shut-in times. These variables were related to the reservoir parameters using appropriate dimensionless groups. The equations were developed by using the unsteady-state flow model of the line source for an infinite, homogeneous reservoir that contains a single-phase, slighly compressible fluid. A computer program was written to calculate the values of the three corresponding time lags and the response amplitudes at given dimensionless cycle periods and pulse ratios using these general equations. For different values of the pulse ratio ranging from 0.1 to 0.9, the time lags and response amplitudes were calculated for dimensionless cycle periods ranging from 0.44 to 7.04. This range of cycle period and pulse ratio covered all practical ranges over which pulse testing can be used effectively. Curves relating the dimensionless time lag to the dimensionless cycle period and the dimensionless response amplitude were constructed for each case. It was also found that both the dimensionless cycle period and the dimensionless response amplitude could be represented as simple exponential functions of the dimensionless time lag. The coefficients of these relations are functions only of the pulse ratio. (Prickett-ISWS)
W76-03371

NEW TRITIUM DATA ON MOVEMENT OF GROUNDWATER IN WESTERN FRESNO COUNTY, CALIFORNIA,
Geological Survey, Sacramento, Calif.
For primary bibliographic entry see Field 5B.
W76-03388

MIXING OF THERMAL AND NONTHERMAL WATERS IN THE MARGIN OF THE RIO GRANDE RIFT, JEMEZ MOUNTAINS, NEW MEXICO,
Geological Survey, Albuquerque, N. Mex.
For primary bibliographic entry see Field 2K.
W76-03393

CHEMICAL QUALITY OF GROUND WATER IN THE NORTHERN PART OF THE ALBUQUERQUE-BELEN BASIN, BERNALILLO AND SANDOVAL COUNTIES, NEW MEXICO,
Geological Survey, Albuquerque, N. Mex.
For primary bibliographic entry see Field 5B.
W76-03394

MAP OF THE ANTELOPE VALLEY-EAST KERN WATER AGENCY AREA, CALIFORNIA, SHOWING GROUND-WATER SUBUNITS AND AREAS, LOCATION OF WELLS, AND WATER-LEVEL CONTOURS FOR SPRING 1975,
Geological Survey, Garden Grove, Calif.
For primary bibliographic entry see Field 7C.
W76-03396

HYDROLOGY OF THE SOUTH PLATTE RIVER VALLEY, NORTHEASTERN COLORADO,
Geological Survey, Denver, Colo.
R. T. Hurr, P. A. Schneider, Jr., and D. R. Minges.
Colorado Water Conservation Board, Denver, Water Resources Circular No 28, 1975. 24 p, 13 fig, 5 plate, 1 tab, 28 ref.

Descriptors: *Irrigation water, *Water yield, *Surface waters, *Groundwater, *Hydrologic data, Water quality, Water yield, Water management(Applied), Diversion, Hydrology, Evaluation, *Colorado.
Identifiers: *South Platte River valley(Colo).

The study area occupies about 950 sq mi along the South Platte River between Henderson, Colo., and the Colorado-Nebraska State line and is underlain by valley fill containing an unconfined aquifer which is in hydraulic connection with the South Platte River. The principal use of the water is for irrigation. During 1947-70 the surface-water diversions averaged 981,000 acre-ft annually, and groundwater diversions averaged 420,000 acre-ft annually. Groundwater seepage to the river decreased by about 250,000 acre-ft per year, and groundwater storage decreased by 456,000 acre-ft. About 45 to 50 percent of the applied irrigation water recharges the groundwater system, a large part of which ultimately seeps into the river. Owing to the consumption losses, however, the recharged groundwater is higher in dissolved solids than the applied irrigation water so that there is a general increase in dissolved-solids concentration in a down-gradient and a down-valley direction. There also tends to be an increase in dissolved-solids concentration in the river in a down-valley direction. In the South Platte River valley, surface water and groundwater are the components of one hydraulic system, and an analysis of water-management practices must consider the interrelation between them in quantitative terms. The description of the system and its operation as presented provide a foundation upon which such analysis can be made. (Woodard-USGS)
W76-03398

ANALOG MODEL STUDY OF THE HYDROLOGY OF THE SAN LUIS VALLEY, SOUTH-CENTRAL COLORADO,
Geological Survey, Denver, Colo.
P. A. Emery, E. P. Patten, Jr., and J. E. Moore.
Colorado Water Conservation Board, Denver, Water Resources Circular No 29, 1975. 21 p, 8 fig, 13 plate, 2 tab, 12 ref.

Descriptors: *Water resources, *Irrigation water, *Hydrology, *Analog models, *Colorado, Surface waters, Groundwater, Water wells, Aquifer characteristics, Water yield, Drawdown, Evaluation, Withdrawal, Groundwater movement, Forecasting.
Identifiers: *San Luis valley(Colo).

The San Luis Valley of south-central Colorado is one of the most productive irrigated areas of the State. Groundwater from unconfined and confined aquifers, and surface water are used to sustain crop production. A three-layer electric analog model that simulated the upper 3,120 feet of the valley-fill aquifer was constructed as part of a study of the San Luis Valley by the U.S. Geological Survey. The model simulates hydrologic boundaries, storage, trasmissivity, and interconnection of the aquifers. It consists of three interconnected resistor grids or layers which simulate the unconfined aquifer and the upper and lower parts of the confined aquifer. Water withdrawn from the upper part of the confined aquifer is derived from six sources: storage in the upper part of the confined aquifer, storage in the lower part of the confined aquifer, storage in the unconfined aquifer, salvaged evapotranspirtation, the Rio Grande, and the Conejos River. The analog analyses indicate that significant amount of nonbeneficial evapotranspiration is salvaged as a result of withdrawing water from the confined aquifer. Analog analyses also show that present groundwater withdrawal from the confined aquifer south of the Rio Grande depletes the flow of the Conejos River by an amount nearly 50 times greater than withdrawal from wells north of the Rio Grande. (Woodard-USGS)
W76-03403

WATER QUALITY, FOUNTAIN AND JIMMY CAMP VALLEYS, COLORADO, 1973,
Geological Survey, Denver, Colo.
For primary bibliographic entry see Field 5B.
W76-03404

LEGAL CONTROLS FOR PROTECTING UNDERGROUND SOURCES OF DRINKING WATER,
Virginia Polytechnic Inst. and State Univ., Blacksburg. Water Resources Research Center.
For primary bibliographic entry see Field 5F.
W76-03435

CONTAMINANTS IN RAINWATER AND THEIR RELATION TO WATER QUALITY, PART II,
Suffolk County Dept. of Environmental Control, N. Y.
For primary bibliographic entry see Field 5A.
W76-03445

4C. Effects On Water Of Man's Non-Water Activities

WINTER SOIL WATER DYNAMICS,
Alaska Univ., College. Inst. of Water Resources.
For primary bibliographic entry see Field 2G.
W76-03002

A TIMBER-WATER SIMULATION MODEL FOR LODGEPOLE PINE WATERSHEDS IN THE COLORADO ROCKIES,
Colorado State Univ., Fort Collins, Dept. of Forest and Wood Sciences.
For primary bibliographic entry see Field 4D.
W76-03167

TWO DECADES OF FLOOD-PLAIN MANAGEMENT: THE TVA REGIONAL EXPERIENCE,
Tennessee Valley Authority, Knoxville. Local Flood Relations.
For primary bibliographic entry see Field 6F.
W76-03271

STUDIES OF SELECTED PRECIPITATION CASES FROM METROMEX.
Illinois State Water Survey, Urbana.
For primary bibliographic entry see Field 2B.
W76-03353

THE EFFECT OF TIMBER REMOVAL ON THE STABILITY OF FOREST SOILS,
Forest and Range Experiment Station, Rangiora (New Zealand). Div. of Protection Forestry.
C. O'Loughlin.
Journal of Hydrology (New Zealand), Vol 13, No 2, p 121-134, 1974. 7 fig, 4 tab, 22 ref.

Descriptors: *Forest soils, *Forest watersheds, Piezometers, Seepage, Cohesion, Root development, Slopes, Sheer stress, Pore water, Lumbering, Lumber, Pressure.
Identifiers: *New Zealand, Forest cover, Deforestation, Soil movement, Hill country, Soil cohesion, Winch, Scaler, Shear box.

The principal ways in which the removal of a forest cover influences the stability of sloping soils were briefly described. In order to review the cause-and-effect relationships between deforestation and mass soil movements, particularly landslides, simple slope stability analyses were applied to an infinite slope under dry and saturated conditions. The methods by which relevant soil physical data can be obtained for use in stability analysis were outlined. Although the analyses were fraught with uncertainties, they illustrated how deforestation could effect changes in the stability of steep slopes. In New Zealand, where an expanding timber industry had its eye on large tracts of commercially valuable forests established on steep hill country, the need for soil physical data was obvious. (Roberts-ISWS)
W76-03361

WATER AND THE SOUTH FLORIDA ENVIRONMENT,
Geological Survey, Miami, Fla.
For primary bibliographic entry see Field 5C.
W76-03402

HYDROLOGIC DATA FOR URBAN STUDIES IN THE SAN ANTONIO, TEXAS METROPOLITAN AREA, 1973,
Geological Survey, Austin, Tex.
For primary bibliographic entry see Field 7C.
W76-03406

SOME INITIAL EFFECTS ON WATER QUANTITY AND QUALITY OF AN EXPERIMENTAL ROADING AND TIMBER HARVESTING OPERATION IN A VICTORIAN MOUNTAIN CATCHMENT,
Melbourne and Metropolitan Board of Works (Australia).
P. N. Kriek, and P. J. O'Shaughnessy.
Report No. MMBW-W-0002, 1975. 20 p, 10 fig, 4 tab, 2 ref.

Descriptors: *Forest watersheds, *Clear-cutting, *Water quality, *Water yield, *Australia, Forest management, Watershed management, Soil moisture, Streamflow, Watersheds(Basins), Vegetation effects, Road construction, Rainfall-runoff relationships.
Identifiers: Eucalyptus-regnans, Central Highlands(Vic.).

Studies on three experimental catchments supporting mature Eucalyptus regnans forest in the Central Highlands of Victoria (Australia), are reported. A highly significant increase in streamflow yield in the two years following a total clear-felling forest operation is demonstrated, with much less significant increases in the year following an operation which removed approximately fifty percent of the stand. Six water quality parameters during base flow periods indicated a significant deterioration in the short term, with a tendency to recovery becoming apparent. (CSIRO)
W76-03447

CHANGE IN YIELD OF WATER FOLLOWING A BUSHFIRE IN A FOREST OF EUCALYPTUS REGNANS,
Melbourne and Metropolitan Board of Works (Australia).
K. J. Langford.
Report No. MMBW-W-0003, 1975. 53 p, 13 fig, 17 tables, 34 ref.

Descriptors: *Forest fires, *Forest watersheds, *Water yield, *Vegetation effects, *Australia, Watersheds(Basins), Rainfall-runoff relationships, Streamflow, Water supply, Water loss, Costs.
Identifiers: Eucalyptus-regnans, Melbourne(Vic.).

Previous observations have indicated that the effects of forest regeneration following severe bushfires in the catchment areas of Melbourne (Australia) in 1939 included in a reduction in streamflow from the area. A historical study is reported which establishes the statistical significance of this reduction, assesses its economic importance, and considers its likely causes. Preliminary evidence of a tendency for streamflows to return to pre-1939 levels is reported. (CSIRO)
W76-03449

THE INFLUENCE OF LAND USE ON STREAM SALINITY IN THE MANJIMUP AREA, WESTERN AUSTRALIA.
Western Australian Department of Agriculture Technical Bulletin No. 27, December 1974, 32 p, 13 tab, 6 fig, 20 ref, append. Report compiled by a Study Group (Ed. C.H. Trotman).

Descriptors: *Land clearing, Forestry, *Salinity, *Streams, *Australia, *Land use, Rainfall, Arid lands, Lumbering, Model studies, Regression analysis, *Forest management.
Identifiers: Manjimup(W.A.).

A review of the history of land use and stream salinity in a proposed wood-chip area in southwest Western Australia indicated that increases in salinity were associated with clearing for agriculture in areas receiving less than 1000 mm annual rainfall. Areas receiving more than 1,100 mm annual rainfall appear to reach a new and lower salinity equilibrium following forestry or clearing after 18 to 145 years. Modelling for salt and water balances in a particular 45,000 ha catchment predicted that agricultural development alone would produce larger salinity increases than cutting for wood-chips, but that the two effects were likely to be additive. It is noted that multiple regression analysis of relevant catchment factors would offer a useful means of rating potential contributors to stream salinity. (CSIRO)
W76-03452

4D. Watershed Protection

FLOW FORECASTING FOR THE BULL RUN WATERSHED,
Multinomah County Div. of Planning and Development, Portland, Oreg.
G. G. Palmer.
Journal American Water Works Association, Vol 67, No. 11 p 608-611, November 1975. 3 fig.

Descriptors: *Model studies, *Flood forecasting, *Design storm, *Probable maximum precipitation, *Landslides, *Oregon, Forest management, Spillways, Reservoirs, Erosion control, Synthetic hydrology.
Identifiers: *Bull Run Reservoir(Ore), Hydocomp simulation program.

As a result of a 1972 landslide in the Bull Run area of Oregon, a simulation of the hydrologic behavior of the watershed was undertaken to assess the safety of the existing spillway structure for a flood generated by a standard project storm and to guard against any future occurrence of slides. The investigative team elected to use the Hydrocomp Simulation Program, which is founded on the Stanford University water-shed model. Pertinent physical, geological, meteorological and hydrological information was collected and the model calibrated. Standard project storm ranged between 40 and 60% of the probable maximum precipitation. The spillway was found safe for the standard project flood. However, some erosion-control measures and strengthening of the stilling basin were indicated. Simulation of watershed behavior was helpful in providing flows to serve as basis for engineering calculation. (Singh-ISWS)
W76-03109

THE OFF-SITE SEDIMENT DAMAGE FUNCTION IN SELECTED ILLINOIS WATERSHEDS,
Illinois Univ. at Urban-Champaign. Dept. of Finance.
K. L. Guntermann, M. T. Lee, and E. R. Swanson.
Journal of Soil and Water Conservation, Vol 30, No 5, p 219-224, September-October 1975. 1 fig, 3 tab, 28 ref.

Descriptors: *Sediments, *Sediment yield, *Illinois, Watersheds(Basins), Erosion, Agricultural watersheds, Soil erosion, Reservoir silting, Economic impact, Damages, Estimating.
Identifiers: *Sediment damage, *Off-site sediment damage, Agricultural practices, Economic analysis.

Estimates of the off-site sediment damage costs for selected agricultural watersheds in Illinois indicated that these costs typically are 10 to 15% of private net income and can be much higher under contemporary farming techniques. In addition, off-site damage costs appear to be many times larger than on-site sediment damage costs (production effects). This suggested that soil conservation efforts should be refocused to include considerations of the social costs caused by off-site sediment damages. (Lee-ISWS)
W76-03126

WIND EROSION: UNIFORMLY SPACING NONERODIBLE ELEMENTS ELIMINATES EFFECTS OF WIND DIRECTION VARIABILITY,
Agricultural Research Service, Manhattan, Kans.
L. Lyles, and B. E. Allison.
Journal of Soil and Water Conservation, Vol 30, No 5, p 225-226, September-October 1975. 4 fig, 12 ref.

Descriptors: *Wind erosion, *Wind velocity, Erosion, Erosion control, Winds, Crops, Agriculture, Soil erosion.
Identifiers: *Wind tunnels, *Wind direction, Crop spacing, Crop height, Crop equidistant spacing.

Wind tunnel studies suggested that equidistant spacing of nonerodible elements, such as plants at various populations, provides equal protection from wind erosion, regardless of wind direction. The protection equals that of elements in rows oriented normally (perpendicular) to wind direction (row spacing in experimental data did not exceed 61 cm). These observations assumed equal numbers of elements per unit area for any orientation. (Lee-ISWS)
W76-03127

WATER QUALITY IN A TROPICAL RAIN FORESTED CATCHMENT,
University of New England, Armidale (Australia). Dept. of Geography.
For primary bibliographic entry see Field 5B.
W76-03132

MODELS OF LAND AND WATER ALLOCATION TO IMPROVE ENVIRONMENT AND WATER QUALITY THROUGH SOIL LOSS CONTROLS,
Iowa State Univ., Ames. Center for Agricultural and Rural Development; and Iowa State Univ., Ames. Dept. of Economics.
For primary bibliographic entry see Field 5G.
W76-03164

A TIMBER-WATER SIMULATION MODEL FOR LODGEPOLE PINE WATERSHEDS IN THE COLORADO ROCKIES,
Colorado State Univ., Fort Collins, Dept. of Forest and Wood Sciences.
D. R. Betters.
Water Resources Research, Vol 11, No 6, p 903-908, December 1975. 3 fig, 2 tab, 19 equ, 32 ref.

Descriptors: *Timber, *Water yield, *Watersheds(Basins), *Forests, Hydrology, *Simulation analysis, Management, Long-term planning, Effects, *Colorado, *Rocky Mountain Region, Lodgepole pine trees, Estimating, Natural resources, Decision making, Equations, Computer programs, Systems analysis, Mathematical models.
Identifiers: Prediction, Multiple-use concept, Submodels.

A deterministic, dynamic joint production simulation model was developed to predict annual timber and water yields over an extended time period. The model provides for testing the long-term effects of various managerial strategies and thus acts as an aid to analyzing and studying proposed management plans. The simulation may be applied to lodgepole pine subalpine watersheds along the Colorado Rocky Mountain Front Range region. The input requirements for the simulation include initial stand conditions, stable site characteristics, watershed location along the Front Range, and the proposed timber-harvesting schedule. The simulator was tested by comparing model predictions to observed records of two Colorado watersheds. The average error of estimation in predicting long-term water yields was about 14%.
W76-03167

HYBRID FORMULATION OF KINEMATIC WAVE MODELS OF WATERSHED RUNOFF,
New Mexico Institute of Mining and Technology, Socorro.
For primary bibliographic entry see Field 2E.
W76-03355

AN ESTIMATE OF TOTAL SURFACE AREA OF VEGETATION FOR PUKEITI CATCHMENT, NORTHLAND, NEW ZEALAND,
Ministry of Works and Development, Nelson (New Zealand).
W. D. Burke.
Journal of Hydrology (New Zealand), Vol 13, No 2, p 115-120, 1974. 3 fig, 1 tab, 7 ref.

Descriptors: *Interception, *Cover crops, *Vegetation effects, *Evaporation, Canopy, Leaves, Stemflow, Runoff, Rainfall.
Identifiers: *New Zealand, *Manuka, *Surface index.

Calculation of the total surface area of vegetation in a catchment was proposed to estimate the amount of surface active in rainfall interception and evaporation. Mapping and sampling of vegetation in the Pukeiti catchment, which has a ground surface area of 1.45 ha and a vegetative cover of Leptospermum scoparium J. R. and G. Forst. (manuka) scrub, was accomplished by a technique described in the paper. The computed total surface area of the manuka, including twigs, branches, stems, and leaves (one side only), was 1.04 ha. The ratio of vegetative surface area to ground surface area, tentatively labeled the surface area index, was 0.72 with a standard error of 0.06. Previous studies had implied a value on the order of 1.2 for the ratio of vegetative surface area to ground surface area in a similar catchment. (Bender-ISWS)
W76-03360

THE EFFECT OF TIMBER REMOVAL ON THE STABILITY OF FOREST SOILS,
Forest and Range Experiment Station, Rangiora (New Zealand). Div. of Protection Forestry.
For primary bibliographic entry see Field 4C.
W76-03361

5. WATER QUALITY MANAGEMENT AND PROTECTION

5A. Identification Of Pollutants

WATER QUALITY IN IOWA STREAMS: SUMMARY OF A CONFERENCE HELD MARCH 1975.
Iowa State Univ., Ames. Dept. of Animal Ecology. Available from the National Technical Information Service, Springfield, Va 22161 as PB-248 459, $5.00 in paper copy, $2.25 in microfiche. Conference Proceedings, Iowa State Water Resources Research Institute, Ames, No 73, March 1975. 86 p, 8 fig, 7 tab, 334 ref, 2 append. OWRT A-999-IA(9).

Descriptors: *Water quality, *Streams, *Iowa, *Conferences, *On-site investigations, *Sampling, *Aquatic environment, Mississippi River, Agricultural chemicals, On-site data collections, Biota, Reservoirs, Diatoms, Dieldrin, Algae, Phosphates, Nitrates, Coliforms, Fish, Aquatic insects, Dissolved oxygen, Turbidity, Ammonia, Temperature, Trace elements, Tile drainage, Carbon dioxide, Hardness(Water).

On March 4, 1975, a conference on water quality in Iowa streams was held on the Iowa State University campus. The purpose was to bring together those individuals within Iowa who are actively engaged in research on stream water quality and the factors that determine it and to promote discussion regarding any conclusions, hypotheses, or unsolved questions relative to water quality in Iowa streams with the goal of increasing the effectiveness of research programs. This three-part publication is intended to serve as a summary of the conference and to document available past and current work on Iowa streams. Part I contains titles and abstracts of the talks given at the conference. Part II is a bibliography of papers and reports dealing with stream water quality in Iowa. Part III summarizes current sampling programs on specific Iowa streams. Information regarding study reach, sampling schedules, parameters measured, methods of analyses, and data availability are given in alphabetical order by stream. The last two sections were based in part on questionnaires distributed to various investigators prior to and during the conference. The conference achieved its objectives. The participants were exposed to a great diversity of research areas and approaches, and many informative discussions developed. This summary should serve as a baseline for stream water quality work in Iowa and provide a starting point for further investigations in this area.
W76-03004

THE TIME STABILITY OF DISSOLVED MERCURY IN WATER SAMPLES--II. CHEMICAL STABILIZATION,
Geological Survey, Menlo Park, Calif.
P. Avotins, and E. A. Jenne.
Journal of Environmental Quality, Vol 4, No 4, p 515-519, October-December, 1975. 8 fig, 2 tab, 12 ref.

Descriptors: *Water chemistry, *Chemical reactions, *Mercury, *Stability, *Aqueous solutions, Solutes, Volatility, Solubility, Storage, Time, Laboratory tests, Bacteria, Analytical techniques, Evaluation, Organic acids.
Identifiers: *Sample preservation, Oxidizing agents.

Bacteria were found to be the principal cause of instability of mercury in laboratory solutions. The volatilization loss rate increased rapidly after a variable lag period and then leveled off with increasing time. The marked reduction in the loss rate of mercury is a result of its combination with bacterial cells and metabolites. Reagents which either oxidize or solubilize organics removed mercury most effectively from sample containers in which mercury-bearing water had been stored. A small amount of mercury was found to have diffused into the polyethylene bottles. Solute mercury was most effectively stabilized in laboratory solutions and water samples with 0.05% KMnO4 without acidification. (Woodard-USGS)
W76-03009

METHOD AND APPARATUS FOR DETECTING THE DEGREE OF CONTAMINATION OF WASTE WATER,
Katsuhiki Hayashi, Tokyo (Japan). (Assignee).
S. Sema, and I. Sakurada.
U S Patent No 3,917,945, 5 p, 5 fig, 2 ref; Official Gazette of the United States Patent Office, Vol 940, No 1, p 489, November 4, 1975.

Descriptors: *Patents, *Waste water, *Waste identification, *Water pollution sources, Fluorescence, X-ray fluorescence, *Pollutant identification, Analytical techniques.

A method and apparatus is described which is capable of continuously determining all contamination components contained in waste water discharged in large quantity. Lights from light sources are projected upon a constant flow of the waste water and the quantity of the luminescence emitted by the constant flow and the quantities of the infrared rays and of the ultraviolet rays absorbed by the constant flow are measured simultaneously and the result of the measurement is analyzed by a computer to determine the degree and type of the contamination. The result of the analysis is recorded on a recording chart. The quantities of fluorescent oil component and the solid components are directly determined from the intensity of fluorescence and the absorption of the infrared light, respectively. The quantity of the oil components that do not fluoresce can be determined by subtracting the absorption for the ultraviolet light corresponding to the other oil components and the quantity of the absorbed infrared light from the quantity of the absorbed ultraviolet light. Thus, the quantities of the fluorescent oil, the non-fluorescent oil and the solid particles are determined separately. (Sinha-OEIS)
W76-03014

SPECTRAL ANALYSIS OF OLFACTORY RESPONSES TO AMINO ACIDS IN RAINBOW TROUT, SALMO GAIRDNERI,
Tokyo Univ. (Japan). Zoological Inst.; and Tokyo Univ. (Japan). Faculty of Sciences.
For primary bibliographic entry see Field 5C.
W76-03017

MERCURY AND IRON UPTAKE BY CYTOSOMES IN MANTLE EPITHELIAL CELLS OF QUAHOG CLAMS (MERCENARIA MERCENARIA) EXPOSED TO MERCURY,
National Inst. of Environmental Health Sciences, Research Triangle Park, N.C. Environmental Toxicology Branch.
For primary bibliographic entry see Field 5C.
W76-03027

THE INFLUENCE OF ACTIVITY LEVEL ON BRADYCARDIA IN TROUT (SALMO GAIRDNERI) DURING HYPOXIA,
Boston Univ., Mass. Dept. of Biology.
For primary bibliographic entry see Field 5C.
W76-03031

IMPROVED FLOWING WATER APPARATUS FOR THE CULTURE OF BRACHYURAN CRAB LARVAE,
Oregon State Univ., Newport. Marine Science Center.
D. V. Buchanan, M. J. Myers, and R. S. Caldwell.
Journal of the Fisheries Research Board of Canada, Vol 32, No. 10, p 1880-1883, 1975. 2 fig, 1 tab, 11 ref.

Descriptors: *Design, *Methodology, Technology, *Flow system, Laboratory tests, Toxicity, *Crabs, Crustaceans, Growth stages, Tests, Cultures.
Identifiers: *Flowing water system, Cancer magister.

A flowing water system was described for culture of brachyuran crab larvae. This system, which is suitable for toxicant exposure studies, employed a flow reversal principle and a minimal area of screen placed low on the side of the culture containers. The design minimized the problem of larval entrapment in water exit screens. Survival of cancer magister zoere in rearing tests lasting up to 60 days compared favorably with survivals obtained previously using static culture methods. (Klein)
W76-03035

APPARATUS FOR CONTINUOUSLY SATURATING WATER WITH HYDROPHOBIC ORGANIC CHEMICALS,
National Water Quality Lab., Duluth, Minn.
G. D. Veith, and V. M. Comstock.
Journal of the Fisheries Research Board of Canada, Vol 30, No 10, p 1849-1851, 1975. 2 fig, 6 ref.

Descriptors: Technology, *Methodology, *Design, Toxicity, Laboratory studies, Bioassay, Organic wastes.
Identifiers: *Water saturation, *Hydrophobic organic chemicals.

An apparatus for generating and maintaining water solutions saturated with hydrophobic organic chemicals was described. The saturator replaced the reagent stock bottle and the organic solvents used in conventional diluters and had ample capacity to dose large volumes of water necessary for long-term toxicology studies with aquatic organisms. The water in a constant-level reservoir was continuously saturated with the chemical by circulating the water through a bed of an inert substrate impregnated with the chemical under investigation. (Klein)
W76-03047

PROPORTIONAL DILUTER FOR EFFLUENT BIOASSAYS,
Michigan Dept. of Natural Resources, Lansing. Water Resources Commission.
C. W. Riley.
Journal of the Water Pollution Control Federation, Vol 47, No 11, p 2620-2627, 1975. 5 fig, 3 ref.

Descriptors: *Waste dilution, *Bioassay, *Methodology, Design, *Effluents, Laboratory tests, Toxicity, Water quality, *Pollutant identification.
Identifiers: *Continuous flow dilution, *Proportional diluter.

The Wuerthele and Riley proportional diluter was a continuous flow diluting device designed to be used in on-site bioassays of complex industrial and municipal wastewater effluents, using the receiving water as diluent. This diluter provided a reasonable flow rate of test solution per gram of fish (31/g/day) that accommodated 104 g of fish/test unit and, when used with the described bioassay containers, provided a 99 percent replacement time of less than 30 minutes. Testing with a weak acid solution and a salt solution revealed that this new diluter delivers test solution concentrations well within the accepted tolerance limits of plus or minus 5 percent. The testing also showed that there is no measurable difference in the concentration of test solution delivered to replicate test containers. The Wuerthele and Riley proportional diluter was easily assembled and maintained. It was constructed of durable acrylic plastic which made it adaptable to many mobile laboratory installations and portable field operations. (Klein)
W76-03051

PROBLEMS ASSOCIATED WITH LOW-SOLUBILITY COMPOUNDS IN AQUATIC TOXICITY TESTS: THEORETICAL MODEL AND SOLUBILITY CHARACTERISTICS OF AROCLOR 1254 IN WATER,
Environmental Protection Agency, Gulf Breeze, Fla. Gulf Breeze Environmental Research Lab.
W. P. Schoor.
Water Research, Vol 9, p 937-944, 1975. 3 fig, 8 tab, 14 ref.

Descriptors: *Theoretical analysis, *Solubility, *Methodology, *Bioassay, Analytical techniques, Aquaeous solutions, Toxicity, Water chemistry, Aroclors, Testing, Pollutant identification.
Identifiers: *Aroclor 1254.

A theoretical model of the behavior of substances having low water-solubility was presented and discussed with respect to aqueous bioassay. Ultracentrifugal techniques were used in an attempt to study size distributions of Aroclor 1254 aggregates in aqueous emulsions. Results indicated strong adsorption from emulsion by surfaces and a water-solubility at 20C of less than 0.1 micrograms/liter in distilled water and approximately 40% of that value in water containing 30g/l NaCl. Implications with regard to aqueous bioassay were discussed. (Klein)
W76-03052

POLAROGRAPHIC DETERMINATION OF ARSENIC IN INDUSTRIAL AND DRAINAGE WATERS (POLYAROGRAFICHESKOE OPREDELENIE MYSH'YAKA V PROMYSHLENNYKH I STOCHNYKH VEDAKH),
N. G. Elenkova, and R. A. Tsoneva.
Zhurnal Analiticheskoe Khimii, Vol 29, No 2, p 289-293, 1974. 3 fig, 4 tab, 11 ref.

Descriptors: Waste water treatment, *Industrial wastes, Analytical techniques, *Pollutant identification, *Arsenic compounds, Polarographic analysis, Heavy metals, Chemical precipitation, Drainage water.

A new polarographic method for the determination of arsenic in industrial and drainage water is proposed. Arsenic is coprecipitated on a Fe(OH)3 collector. After reducing and dissolving the precipitate in ascorbinic acid, the arsenic is determined polarographically in mixture of ascorbinic and citric acids. The method is useful for fast and serial analyses in industrial laboratories. The sensitivity of the method is 0.024 mg/liter, and the variation coefficient is 21% when 56 micrograms of As are determined. The analysis is not interfered with by Cu, Hg, Fe, Pl, Mu, Co, Ni, Se, Te, Ag, Zn, Au, Sb. (Murphy-FIRL)
W76-03068

AQUIFER EVALUATION USING DEPOSITIONAL SYSTEMS: AN EXAMPLES IN NORTH-CENTRAL TEXAS,
Dames and Moore, Boca Raton, Fla.
For primary bibliographic entry see Field 2F.
W76-03111

ATMOSPHERIC REAERATION IN A RIVER USING PRODUCTIVITY ANALYSIS,
Virginia Univ., Charlottesville.
For primary bibliographic entry see Field 5G.
W76-03115

FLUOMETURON AND WATER CONTENT DISTRIBUTIONS DURING INFILTRATION: MEASURED AND CALCULATED,
Oklahoma State Univ., Stillwater. Dept. of Agronomy.
For primary bibliographic entry see Field 5B.
W76-03123

APPLICATION OF THE WIND EROSION EQUATION IN AIR POLLUTION SURVEYS,
L. Wilson.
Journal of Soil and Water Conservation, Vol 30, No 5, p 215-219, September-October 1975. 13 ref.

Descriptors: *Wind erosion, *Dusts, *Air pollution, *Soil classification, *Vegetation effects, *New Mexico, Control, Climatic data, Resistance, Land management, Arid lands.
Identifiers: *Airborne particulates.

The wind erosion equation was applied to a generalized and regional basis in several areas of New Mexico for determining the extent of natural dust in the atmosphere. This application involved the use of wind erodibility ratings for soil associations, protective effect of rangeland vegetation, and roughness and climate variables. It was found that even 0.3% of the calculated gross erosion as dust load was enough to exceed air pollution standards in some urban area. Expensive land use management practices to reduce such pollution are not needed. Pollution control efforts need to be channeled to areas where pollution is the direct result of human action and, therefore, subject to reduction. Properly used, the wind erosion equation promises to be of considerable value in helping separate naturally dusty areas from those where pollution is of immediate concern. (Singh-ISWS)
W76-03125

ISOTOPIC COMPOSITION OF GROUNDWATER IN SEMI-ARID REGIONS OF SOUTHERN AFRICA,
National Physical Research Lab., Pretoria (South Africa).
For primary bibliographic entry see Field 2K.
W76-03130

MOVEMENT OF HERBICIDES IN SOIL BY MASS FLOW,
Iowa State Water Resources Research Inst., Ames.
For primary bibliographic entry see Field 5B.
W76-03134

PHENOLS IN THE CLARK FORK RIVER,
Montana Univ., Missoula. Dept. of Chemistry.
For primary bibliographic entry see Field 5B.
W76-03136

WATER QUALITY PERCEPTION BY USERS: CAN IT SUPPLEMENT OBJECTIVE WATER QUALITY MEASURES,
Great Lakes Forestry Research Center, Sault Sainte Marie (Ontario).
For primary bibliographic entry see Field 5G.
W76-03168

SUPPRESSION OF IRON (III) INTERFERENCE IN THE DETERMINATION OF IRON (II) IN WATER BY THE 1,10-PHENANTHROLINE METHOD,
H. Fadrus, and J. Maly.
Analyst, Vol 100, p 549-554, August, 1975. 2 tab, 4 fig, 8 ref.

Descriptors: *Photometry, *Heavy metals, *Iron, *Chelation, *Analytical techniques, Colorimetry, *Pollutant identification, Nitrilotriacetic acid.
Identifiers: Ion interference, Complexones, Masking.

A method for the determination of iron (II) in water in the presence of iron (III) with 1,10-phenanthroline is described, in which the interfering effect of iron (III) ions is suppressed by masking with complexones. The advantages of compexones, especially nitrilotriacetic acid (NTA) which was found to be most suitable, over other chelating agents are discussed. (Hoyle-Vanderbilt)
W76-03169

GREASE PROBLEMS IN MUNICIPAL WASTEWATER TREATMENT SYSTEMS,
MCA Engineering Corp., Baltimore, Md. Environmental Div.
For primary bibliographic entry see Field 5D.
W76-03225

WASTE WATER TREATING OPERATION USING MICROBIAL MEMBRANE (I). ANALYSIS OF RESISTANCE TO MOVEMENT WITHIN LIQUID PHASE,
H. Kubota, S. Omi, H. Tatsumi, and S. Waki.
Preprint of the Chemical Engineering Society, Tokyo, Japan, p 92-93, 1975. 4 fig, 2 tab, 1 ref.

Descriptors: *Flow rates, *Analytical techniques, *Microorganisms, Membrane processes, Laminar flow, Pollutant identification, Waste water treatment.

The analysis of resistance to movement of oxygen in the liquid phase was carried out by batch operation using two types of microbial membrane supporters. The first type of supporter allowed the reaction solution to be circulated as a laminar flow. The second type alternated the flow path of the solution every 5 cm. A cultivated solution containing 100 ppm glucose, 100 ppm pepton, 100 ppm K2HPO4, 50 ppm MgSO4, 50 ppm NH3Cl and 10 ppm FeCl2 was circulated at 25 C for 3 to 4 days at a pH of 7.0 to 7.2 to allow the microbial membrane to grow to about 100 microns. A solution containing 100 ppm glucose, 100 ppm K2HPO4, 50 ppm MgSO4, 50 ppm NH4Cl and 10 ppm FeCl2 was used to substitute the cultivated solution, and the unreacted glucose was traced. The reduced sugar was analyzed by a Cu-colorimetric method. Results showed that flow rate significantly affected the reaction rate for the type one supporter but had no apparent effect on the type two supporter. (Su-FIRL)
W76-03230

MODIFICATIONS IMPROVE CHLORINE CONTACT CHAMBER PERFORMANCE, PART I,
Worcester Polytechnic Inst., Mass. Dept. of Civil Engineering.
For primary bibliographic entry see Field 5F.
W76-03231

METHODOLOGY FOR APPLICATION OF ADENOSINE TRIPHOSPHATE DETERMINATION IN WASTEWATER TREATMENT,
Biospherics Inc., Rockville, Md.
For primary bibliographic entry see Field 5D.
W76-03232

AUTOMATED METHODS FOR ASSESSING WATER QUALITY COME OF AGE,
Technicon Industrial Systems, Tarrytown, N.Y.
M. J. F. DuCros, and J. Salpeter.
Environmental Science and Technology, Vol 9, No 10, p 929-933, 935, October, 1975. 2 fig, 5 tab, 2 ref.

Descriptors: *Waste water treatment, *Water quality control, *Automation, Analytical techniques, Equipment, Laboratory tests, Water analysis, Chemical analysis, *Pollutant identification.
Identifiers: Technicon AutoAnalyzer II Continuous-Flow Analytical system.

Automated wet chemistry instrumentation and methodologies for use in water quality laboratories of governmental regulatory agencies and municipal and industrial facilities are discussed with particular reference to equipment available from Technicon Industrial Systems. The Technicon AutoAnalyzer II Continuous-Flow Analytical system is a modular system capable of assaying substances at rates up to 60 samples/hour. The modular design permits the analysis of liquid, solid, or gaseous samples. Detection techniques can include colorimetry, spectrophotometry, flame photometry, fluorometry, atomic absorption spectroscopy and potentiometry. The Technicon Monitor IV system utilizes the same continuous-flow concept of the AutoAnalyzer for continuous on-site measurements. Automated analytical systems enable the user to handle larger analytical workloads more economically, and with improved precision and accuracy. The 1974 edition of EPA's Manual of Methods for Chemical Analysis of Water and Wastes states that instrumental methods have been selected over manual procedures because of their improved speed, accuracy and precision. Twelve procedures for the AutoAnalyzer II are included in the manual for laboratories with this equipment. Information on some of the typical users of automated analytical systems is presented. (Orr-FIRL)
W76-03233

ION ACTIVITY ELECTRODE METHOD YIELDS CHLORIDE ION CONCENTRATION,
Washington State Univ., Pullman. Dept. of Civil and Environmental Engineering.
E. Hindin.
Water and Sewage Works, Vol 5, No 9, p 60-62, September, 1975. 3 tab, 7 ref.

Descriptors: *Chlorides, *Ions, *Analytical techniques, Hydrogen ion concentration, Waste water treatment, *Electrodes, *Pollutant identification, Correlation analysis, Chemical precipitation.

Data gathered during a study conducted in 1974 indicate that the ion specific electrode method can be used in lieu of the standard mercuric nitrate method to determine chloride ion concentration in water and in treated sewage effluents. The maximum allowable pH at which a 3.5 mg Cl/liter solution can be measured by the ion specific electrode method without appreciable error is 11.9; however, the pH of natural waters and most wastes waters is less than that value. When water is very high in ionic strength, the addition of an ionic strength adjusting solution is recommended. When this precautionary step is taken a correlation coefficient of 0.94 is obtained for data gathered by the two methods. The removal of sulfide ions was also recommended when using the ion specific electrode method. The precipitation method, using cadmium ions, was found to be most efficient because it was not time consuming and requires a minimum of sample handling. (Beale-FIRL)
W76-03234

DETERGENT PHOSPHATE BAN YIELDS LITTLE PHOSPHORUS REDUCTION, PART I,
Purdue Univ., Lafayette, Ind. Dept. of Environmental Engineering.
J. E. Etzel, and J. M. Bell.
Water and Sewage Works, Vol 122, No 9, p 91-93, September, 1975. 3 fig, 4 tab, 11 ref.

Descriptors: *Nutrient removal, *Phosphates, *Detergents, *Eutrophication, Water pollution effects, Pollutant identification, Analytical techniques, Legislation, Bioassay, Indiana, Sewage treatment, Waste disposal, Rivers.
Identifiers: Detergent phosphate ban.

A 1974 study was conducted on nutrient levels in Indiana streams and indicated that a January, 1973, legislative ban on detergent phosphates had not reduced stream phosphorus levels enough to prevent the acceleration of eutrophication. When the study was made, the ban on detergent phosphates had been in effect for over 18 months. The nutrient content of the surface waters was measured relative to generally accepted growth-limiting ranges. The presence or absence of growth limitation was established by a bioassay of algal growth potential of the surface waters; the presence or absence of surplus phosphorus in filamentous algae taken from the waters was also measured. The two Indiana river systems from which samples were taken were the Wabash and White River systems. Both are influenced by significant domestic waste water discharges. Results of chemical analyses, laboratory algal bioassay, and plant extraction procedures were displayed in several tables. Because of the detergent phosphate ban had not been successful in reducing the potential for algal growth, it was suggested that nutrient removal through flocculation at sewage treatment plants might be used to reduce the discharge of all nutrients. (Kramer-FIRL)
W76-03235

LANDSAT MEASURES OF WATER CLARITY,
General Electric Co., Beltsville, Md.
D. J. Brooks.
Photogrammetric Engineering and Remote Sensing, Vol 41, No 10, p 1269-1272, October, 1975. 2 fig, 9 ref.

Descriptors: Seston, Transmissivity, Reflectance, Water circulation, Turbidity, Tides, Suspended solids, Currents(Water), Satellites(Artificial), Monitoring, *Pollutant identification, *Potomac River, Virginia, Water quality, Remote sensing.
Identifiers: Gunston Cove(Va), LANDSAT, Water clarity, *Spectral measurements.

LANDSAT reflectance data are compared with in situ transmittance data as a measure of water clarity. Gunston Cove, Virginia, which empties into the Potamac River, was the area chosen for study because: it has an obvious horizontal seston/reflectivity gradient; two streams emptying into the cove and the river provide a continuous contribution of suspended solids; and currents effectively keep materials in suspension. Data were collected during two different times, one at ebb tide and the other during flood tide. In situ measurements were taken at 16 different stations in a straight line approaching the Potomac River. Measurements were taken over four discrete spectral intervals: 0.5 to 0.6 microns, 0.6 to 0.7 microns, 0.7 to 0.8 microns, and 0.8 to 1.1 microns, and at a depth of one half meter with a 10 cm pathlength. LANDSAT reflectance measurements were taken about two hours after the transmittance data were collected. Results showed that during ebb tide

transmittance decreased and reflectance increased on approaching the river, while during flood tide transmittance increased and reflectance decreased. Increasing turbidity presents an increasing reflective surface to incident solar radiation, thus making the inverse correlation logical. Although more testing is required under different conditions and over large areas before correlation between the two types of measurements can be proven, data collected so far indicate that LANDSAT reflectance measurements can be used to complement in situ transmittance measurements. (Pinto-FIRL)
W76-03237

A SURVEY OF THE HEAVY METAL AND INORGANIC CONTENT OF SEWAGE SLUDGES,
University College, Cardiff, (Wales). Dept. of Mineral Exploitation.
R. O. Williams.
Water Pollution Control, Vol 74, No 5, p 607-608, 1975. 6 tab, 2 ref.

Descriptors: *Sewage treatment, *Heavy metals, Metals, *Sludge, Treatment facilities, *Waste water treatment, Waste disposal, Analytical techniques, Zinc, Copper, Lead, Chromium, Nickel, Spectrophotometry, Sampling, *Pollutant identification, Sewage sludge.
Identifiers: Sludge analysis.

A survey was made of 182 sewage treatment plants in England and Wales to determine the inorganic and heavy metal content of sewage sludges prior to their disposal. Plants were categorized as rural, urban, or industrial according to their known industrial waste water intake and contributing populations. The metal content of these sludges was determined by wet chemical methods, using atomic absorption spectrophotometry after destruction of the organic material. Results of inorganic contents of all the sludge samples were summarized in several tables. Metal concentrations for copper, zinc, lead, chromium, and nickel were shown. While the recommended maximum concentration of zinc equivalent in a batch of sewage sludge that can safely be allowed at an application rate of 12.5 ton DS/ha is 0.75%, 33 of the works sampled had sludges with zinc levels exceeding 0.755%. (Kramer-FIRL)
W76-03238

STUDY OF COAGULATION OF WATER BY FLUOROMETRY (ETUDE DE LA COAGULATION DES EAUX PAR FLUOROMETRIE),
Laval Univ., Quebec. Dept. of Civil Engineering.
For primary bibliographic entry see Field 5F.
W76-03239

MONITORING LAB GIVES CITY THE JUMP ON SAFE DRINKING WATER REGULATIONS,
Inglewood Water Dept., Calif.
For primary bibliographic entry see Field 5F.
W76-03240

LABORATORY STUDIES CONCERNING REMOBILIZATION OF PHOSPHATE FROM IRON PHOSPHATE BY COMPLEX AND PRECIPITATION REACTIONS (LABORUNTERSUCHUNGEN UEBER DIE REMOBILISIERUNG VON PHOSPHAT AUS EISENPHOSPHATE DURCH KOMPLEX-UND FAELLUNGSREAKTIONEN,
R. Wagner.
Vom Wasser, Vol 44, p 131-172, 1975. 25 fig, 3 tab, 35 ref.

Descriptors: *Phosphates, *Laboratory tests, *Aerobic conditions, *Anaerobic conditions, Chemical precipitation, Chelation, *Pollutant identification, Analytical techniques.
Identifiers: Remobilization, Iron phosphate.

Laboratory tests were conducted on the remobilization of phosphate from iron phosphate by complex and precipitation reactions. The possibility of phosphate fixation in aerobic and anaerobic environments by iron compounds was investigated. The preparation of precipitated iron phosphate compound, used for the remobilization tests, was described. In aerobic conditions, strong chelating agents, such as EDTA and NTA, were the most effective. Among the hydroxy carboxylic acids, only citric acid had a significant effect. In the presence of calcium ions, the remobilization power of amino polycarboxylic acids was considerably diminished. Under anaerobic conditions, the release of phosphate was controlled by the amount of sulfide ions present if sequestering agents are excluded. Calcium ions also counteracted the remobilization of phosphate from ferrous phosphate by sulfide ions. (Kramer-FIRL)
W76-03241

MUNICIPAL WASTEWATER PLANT PROBLEMS WITH CYANIDE EFFLUENT REGULATIONS,
Metropolitan Sanitary District of Greater Chicago, Ill. Industrial Waste Div.
For primary bibliographic entry see Field 5D.
W76-03247

DISTRIBUTION AND BIOMAGNIFICATION OF HEXACHLOROPHENE IN URBAN DRAINAGE AREAS,
North Carolina Univ., Chapel Hill. Dept. of Environmental Sciences and Engineering; and North Carolina Univ., Chapel. Hill School of Public Health.
For primary bibliographic entry see Field 5B.
W76-03248

SPECTROPHOTOMETRIC DETERMINATION OF RUTHENIUM WITH 3- (2-PYRIDYL) -5, 6-DIPHENYL-1,2,4-TRIAZINE,
Texas Univ. at Austin. Dept. of Chemistry.
L. C. Kamra, and G. H. Ayres.
Analytica Chimica Acta. Vol 78, p 423-429, 1975, 3 fig, 2 tab, 9 ref.

Descriptors: *Heavy metals, *Ruthenium, *Spectrophotometry, *Analytical techniques, *Separation techniques, *Pollutant identification.
Identifiers: Elemental analysis, 3-(2-pyridyl)-5, 6-Diphenyl-1-2-4-triazine(PDT).

Ruthenium (II) reacts with 3-(2-pyridyl) -5, 6-diphenyl-1,2,4-triazine (PDT) in water alcohol solution at pH 5 to give a magentacolored cationic complex having an absorption peak at 485 nm. The color is fully developed by heating at 85C for 30 min. The system conforms to Beer's law; the optimal concentration range for measurement at 1.00-cm optical path is about 0.5-3.4 p.p.m. of ruthenium. The molar absorptivity is 21,000 l/mole-cm. The effects of reagent concentration, heating temperature and time, pH, and alcohol concentration have been studied; maximal absorbance for 2.0 p.p.m. ruthenium occurred with solutions of pH between 4.4 and 5.7, and up to 20% enthanol by volume. Common anions do not interfere. Separation from interfering cations is effected by distillation and recovery of ruthenium tetroxide. Spectrophotometric methods of continuous variations and of mole ratios, and elemental analysis of solid salts isolated from solution indicate a ruthenium-to-PDT stoichiometry of 1:2, the PDT acting as a tridentate ligand. No special precautions regarding time stability need to be taken. (Hoyle-Vanderbilt)
W76-03299

THE USE OF GEL FILTRATION IN THE STUDY OF METAL BINDING BY HUMIC ACIDS AND RELATED COMPOUNDS,
Liverpool Univ. (England). Dept. of Oceanography.
R. F. C. Mantoura, and J. P. Riley.
Analytica Chimica Acta, Vol 78, p 193-200, 1975. 5 fig, 1 tab, 19 ref.

Descriptors: *Heavy metals, *Fulvic acids, *Humic Acids, *Gels, Copper, Nickel, Zinc, Spectrophotometry, *Chromatography, analytical techniques, *Pollutant identification, Metals.
Identifiers: Stability constants, Metal binding, Buffer systems, Molecular binding sites.

A gel filtration technique is described for the study of the complexation of dissolved metals by humic acids and fulvic acids. Measurements can be made under realistic conditions simulating pH and free metal ion concentrations found in natural waters by using tris-(hydroxymethyl)-amino methane (TRIS) for the buffer system. The equilibrated acid sample, dissolved in TRIS buffer, is injected into the gel column previously equilibrated by passage of the metal-TRIS buffer. The metal-buffer is passed through the column while the absorbance of the effluent from the column is monitored at a wavelength appropriate to the concentration of the sample acid expected in the effluent. Fractions are collected and analyzed for the appropriate metal ion by atomic absorption spectrometry or, alternatively, by a gamma-scintillation counter if a suitable gamma-emitting radio isotope is available. The procedure permits the determination not only of the overall stability constant, but of the binding stoichiometrics and the intrinsic stability constants associated with the various types of metal binding sites. The procedure has been applied to the investigation of the interation of fresh-water fulvic acids with copper, zinc, and nickel, and has provided evidence for the existence of two different types of binding sites in the fulvic acid molecule. (Hoyle-Vanderbilt)
W76-03301

EFFECT OF FALLOUT OF WINDBRONE ZINC, LEAD, COPPER AND CADMIUM FROM A FUMING KILN ON SOIL GEOCHEMICAL PROSPECTING AT BERG AUKAS, SOUTH WEST AFRICA,
Cape Town Univ., South Africa. Dept. of Geochemistry.
For primary bibliographic entry see Field 5B.
W76-03302

MAJOR AND TRACE ELEMENT ANOMALIES IN STREAM SEDIMENTS OF THE TEIGN VALLEY OREFIELD,
Southampton Univ. (England). Dept. of Geology.
J. R. Merefield.
Journal of Geochemical Exploration, Vol 3, No 2, p 151-166, May 1974, 1 tab, 5 fig, 33 ref.

Descriptors: *Trace elements, *Heavy metals, *Sedimentary basins(Geologic), Soil analysis, *Minerology, *Water analysis, Petrology, Pollutant identification.
Identifiers: Teign Valley(England).

A detailed geochemical and sedimentological study of twenty-two bulk stream sediments from streams draining Dartmoor granite and Culm in the Teign Valley shows the influence of lithology, mineralization and contamination of such cumulative samples. K, Cu and Ni in stream sediments are potential indicators of lithology. Ba and S values, as well as barytes concentrations, demonstrate the contribution of Ba, Zn and Pb mineral lodes, while Fe, S, and heavy-mineral percentages emphasize that of Fe lodes and contamination. Evidence shows Fe as a scavenger. High Mn values are attributed to precipitations of the metal derived largely from impregnations of the Culm. (Hoyle-Vanderbilt)
W76-03303

DETERMINATION OF SILVER IN BIOLOGICAL MATERIALS BY HIGH-FREQUENCY

PLASMA-TORCH EMISSION SPECTROMETRY,
Government Industrial Research Inst., Nagoya (Japan).
R. Nakashima, S. Sasaki, and S. Shibata.
Analytica Chimica Acta, Vol 77, p 65-70, 1975. 2 fig, 3 tab, 14 ref.

Descriptors: *Heavy metals, *Pollutant Identification, *Spectrometers, *Analytical techniques, *Trace elements, Chemical precipitation, Photometry, Chemistry, Instrumentation, Pollutants.
Identifiers: *Silver, High frequency plasma torches, Emission spectrometry, Biological samples, Whole blood analysis, Bismuth, Coprecipitation, Emission intensity.

High frequency plasma torches provide better reproducibility than conventional methods of excitation in emission spectrometry. They have much higher temperatures than flames, and they can be applied to gaseous, liquid, and solid samples. Nanogram amounts of silver in small samples of biological materials can be determined by high-frequency plasma-torch emission spectrometry. Samples are digested with perchloric and nitric acids, silver is coprecipitated with bismuth iodide, and the precipitate is decomposed with concentrated nitric acid before dilution. Bismuth shows an enhancing effect on the silver emission at 328.06 nm, and the sensitivity is further improved by elimination of moisture in the aerosol with a second condenser at -3 to -5 degrees C. The detection limit is 0.5 ng per 0.2 ml of sample solution. Condensed milk and whole blood were analyzed satisfactorily. (Davis-Vanderbilt)
W76-03304

AN ELECTRON MICROSCOPE AUTORADIOGRAPHIC INVESTIGATION OF THE ACCUMULATION OF ZINC-65 BY A SPECIES OF EUTREPTIA,
Adelaide Univ., (Australia). Dept. of Botany.
M. A. Sims.
Experientia, Vol 31, Fasc. 4, p 426-427, April 15, 1975. 1 tab, 18 ref.

Descriptors: *Heavy metals, *Zinc, Pollutants, *Pollutant identification, *Absorption, Microogranisms, Electron microscopy, Zinc radioisotopes, Ecological distribution, Environmental effects, Biological membranes, Algae, Toxins, Food chains, Australia.
Identifiers: Cell physiology, Autoradiography, Eutreptia, Chloroplasts, Port Pirie(South Australia), Intracellular localization.

Analyses of marine plants and animals have shown that zinc is accumulated to levels up to one thousand times environmental levels. Eutreptia, a single celled marine organism, was studied using autoradiography to find where in the organism zinc is accumulated and in what amounts. Eutreptia were isolated from samples of industrial effluent and maintained in sterile seawater containing radioactive Zn65 for periods of 12 to 24 hours. The organisms were removed by filtration and prepared for electron microscopy. The resulting autoradiographs were examined for developed grains over various organelles and the areas of each organelle estimated. The results were analyzed statistically to determine whether the amount of label over the organelles was proportional to their relative areas. Results show that the Zn65 was accumulated by the organisms and localized in the chloroplasts. (Davis-Vanderbilt)
W76-03308

DETERMINATION OF TUNGSTEN IN GEOLOGIC MATERIALS BY NEUTRON ACTIVATION ANALYSIS,
Geological Survey, College Park, Md.
F. O. Simon, and C. L. Rollinson.
Journal of Research, United States Geological Survey, Vol 3, No 4, p 475-478, July-August, 1975. 3 fig, 2 tab, 9 ref.

Descriptors: *Heavy metals, *Neutron activation analysis, *Pollutant identification, Geology, *Analytical techniques, Separation techniques, Chemical precipitation, Fused salts, Trace elements, Irradiation, Geochemistry, Rocks, Mineralogy.
Identifiers: *Tungsten, Gamma counting, Alpha-benzoinoxime, Half-life, Germanium detectors.

Normal semiquantitative spectrographic methods for measuring tungsten do not possess adequate sensitivity to determine tungsten in geologic materials. A neutron activation analysis technique for determining tungsten in small geological samples (about 100 mg) is discussed. The coefficients of variation for less than p.p.m. concentrations of tungsten are normally less than 20%. The limit of detection is 0.005 ppm. A sample to be analyzed is first irradiated for 1 hour in a thermal neutron flux in a reactor. It is allowed to decay for 24 hours, and 188W is added as a tracer. After fusion with sodium peroxide, tungsten is isolated by extraction into chloroform with alpha-benzoinoxime, back extraction into aqueous potassium hydroxide, and precipitation with alpha-benzoinoxime. The activities of the 0.13 and 0.48 MeV gamma rays are measured. The yield, normally 40 to 90%, is determined by measuring the activity of the 0.155 Mev gamma ray. (Davis-Vanderbilt)
W76-03309

MAGNETIC SUSCEPTIBILITY OF LAKE SEDIMENTS,
Edinburgh Univ., (Scotland). Dept. of Geophysics.
For primary bibliographic entry see Field 2J.
W76-03311

APPLICATION OF THE STAINTON SYRINGE METHOD TO THE ANALYSIS OF MERCURY IN NATURAL WATERS,
Fisheries and Marine Service, West Vancouver (Brittish Columbia). Pacific Environmental Inst.
J. A. J. Thompson, and F. T. McComas.
Environmental Letters, Vol 5, No 3, p 189-197, 1973, 1 fig, 1 tab, 12 ref.

Descriptors: *Heavy metals, *Pollutant identification, Saline water, *Estuarine environment, Analysis, Spectrophotometry, *Mercury.
Identifiers: *Atomic adsorption spectrophotometry, *Stainton adsorption cell, Solvent extraction, Cold-vapor.

A relatively inexpensive, simple and precise method for analyzing subnanogram quantities of mercury in fully saline and estuarine natural waters is described. Through a combination of a solvent extraction procedure and a 'cold-vapor' technique, standard deviations of plus or minus 0.0049 and plus or minus 0.0112 were obtained at mean mercury concentrations of 0.023 and 0.166 ng/ml respectively. The recoveries were 94%. Atomic adsorption spectrophotometry using a Stainton adsorption cell was used for the flameless mercury analysis. The method is ideally suited for routine mercury analysis at sub-nanogram levels. (Gregory-Vanderbilt)
W76-03313

GEOCHEMICAL AND BIOGEOCHEMICAL EXPLORATION RESEARCH NEAR EARLY PRECAMBRIAN PORPHYRY-TYPE MOLYBDENUM-COPPER MINERALIZATION, NORTHWESTERN ONTARIO, CANADA,
Ministry of Natural Resources, Toronto, Ontario, Canada. Ontario Division of Mines.
W. J. Wolfe.
Journal of Geochemical Exploration, Vol 3, No 1, p 25-41, March 1974. 8 fig, 2 tab, 16 ref.

Descriptors: *Geochemistry, *Minerology, *Copper, *Molybdenum, Heavy metals, Conifers, Vegetation effects, *Soil chemistry, Soil surveys, *Canada.
Identifiers: *Biogeochemistry, *Chemical dispersion, Ontario.

A preliminary assessment is presented of surface geochemical and biogeochemical exploration methods in an area of widespread, low-grade Precambrian molybdenite-pyrite-chalcopyrite mineralization complicated by the presence of extensive transported quaternary cover including variable thickness of boulder till and Late Pleistocene lake clay. Data are presented for the distribution of copper and molybdenum in bedrock, soils and vegetation. Discussion is offered about secondary chemical dispersion of copper and molybdenum, and copper and molybdenum uptake in coniferous vegetation. (Hoyle-Vanderbilt)
W76-03315

A STUDY OF THE ATOMIC ABSORPTION DETERMINATION OF SOME IMPORTANT HEAVY METALS IN FERTILIZERS AND DOMESTIC SEWAGE PLANT SLUDGES,
Toronto Univ., (Ontario). Dept. of Geology; and Toronto Univ., (Ontario). Dept. of Chemistry.
J. C. Van Loon, and J. Lichwa.
Environmental Letters, Vol 4, No 1, p 1-8, 1973. 4 tab, 2 ref.

Descriptors: *Heavy metals, *Pollutant identification, *Waste identification, *Sewage sludge, *Fertilizers, Chromium, Copper, Iron, Manganese, Cadmium, Lead, Nickel, Zinc.
Identifiers: *Atomic absorption, Rapid analysis, Sewage fertilizers.

An atomic absorption method was used to rapidly analyze sewage sludges and processed sewage fertilizers. Surprisingly high levels of heavy metals were found in some of the samples; of particular interest were cadmium, chromium, copper, lead, nickel, iron, zinc and manganese. With the exception of nickel, little problem was encountered with intermetal chemical interfences. The light metal ingredients in concentrated sample solutions frequently resulted in appreciable background adsorption, and correction lines were ascertained. The rapid procedure was found to be sufficient for most practical purposes. The sludge samples chosen represent vastly different sewage input patterns, and the measured metal was found to be proportional to the industrial use of the metal in the area. (Gregory-Vanderbilt)
W76-03316

MULTIELEMENT ANALYSIS OF SLUDGE SAMPLES BY INSTRUMENTAL NEUTRON ACTIVATION ANALYSIS,
Cornell Univ., Ithaca, N.Y. Dept. of Chemistry.
R. A. Nadkarni, and G. H. Morrison.
Environmental Letters, Vol 6, No 4, p 273-285, 1974. 3 tab, 9 ref.

Descriptors: *Heavy metals, *Sludge, *Pollutant identification, *Environmental effects, *Toxocity, Trace elements, Iron, Calcium, Copper, Aluminum, Chromium, *Neutron activation analysis, Mercury, Nickel, Vanadium, Rare earths.
Identifiers: *Screening, *Sludged soil.

A multielement survey measuring method using instrumental neutron activation analysis was developed to screen up to 40 trace elements in a variety of sludge samples, as well as in soils in which sludges had been incorporated. The elements determined included 10 major-minors, 10 rare earths, and 20 other trace elements. Included were elements essential to plant/animal life: manganese, sodium, potassium, calcium, iron, vanadium, copper, chromium, selenium, zinc, cobalt and magnesium, as well as elements of toxicological concern: aluminum, antimony, chromium, mercury, nickel, selenium, silver and barium. Samples analyzed included sludge collected from ten Indiana cities, and soil from a field in Columbus, Indiana, which had been treated with sludge. The composition of the sludges was found to vary greatly; the elements present at the highest levels were calcium, iron, aluminum, and mercury. Some sludges

were also rich in copper, chromium, and nickel. In the sludgemtreated soil, composition variation with depth was not very noticeable, and except for chromium, the concentrations increased from the surface to the deeper strata. Especially striking higher concentrations of vanadium , chromium, and nickel were measured. The study demonstrates the feasibility of using the instrumental neutron activation technique for large-scale routine analysis of sludges and soils. (Gregory-Vanderbilt)
W76-03319

TREES AS ENVIRONMENTAL SENSORS MONITORING LONG-TERM HEAVY METAL CONTAMINATION OF SPOKANE RIVER, IDAHO,
Washington State Univ., Pullman. Dept. of Chemical and Nuclear Engineering.
J. C. Sheppard, and W. H. Funk.
Environmental Science and Technology, Vol 9, No 7, p 638-642, July, 1975. 2 fig, 1 tab, 20 ref. OWRT B-044-WASH(4).

Descriptors: *Heavy metals, *Dendrochronology, Rivers, *Neutron activation analysis, *Ponderosa pine trees, Mining, Sediments, Cores, Mercury, Chromium, *Idaho, Zinc, Cobalt, Iron, *Pollutant identification.
Identifiers: *Environmental sensors, *Gamma-emitting radionuclides, Spokane River(Idaho), Coeur d'Alene Lake(Idaho), Post Falls(Idaho), Silver, Rhodium.

Ponderosa pine trees growing on the bank of the Spokane River, Idaho, were used to monitor the river's concentrations of Hg, Cr, Ag, Rb, Zn, Co, and Fe over the past 60-70 years. Using neutron activation analysis, sections of cores and tree rings were studied to determine the metal content as a function of tree ring age. Data were compared with sediment core data from Coeur d'Alene Lake and the dates of peak mining activity in the Coeur d'Alene mining district. Although this is a preliminary study, results indicate that long-lived trees growing in intimate contact with rivers may be used to monitor variations of metal ion concentrations in rivers for times approaching a century. Although the correlation between the tree and mining data is general, more specific analysis may be accomplished by incorporating originial heavy metal levels and river flow data into the study. (Davis-Vanderbilt)
W76-03320

OXYGEN TRANSFER IN FERMENTATION,
Iowa State Univ., Ames. Dept. of Chemical Engineering.
G. T. Tsao, and D. D. Lee.
AIChE Journal, Vol 21, No 5, p 979-985, September, 1975. 7 fig.

Descriptors: Analytical techniques, *Waste water treatment, *Mass transfer, *Oxygen, Air-water interfaces, Surfactants, Fermentation, Aerobic conditions, *Pollutant identification.
Identifiers: *Oxygen sensing microprobe, *Oxygen transfer, Danchkwerts theory.

An experimental investigation of interfacial resistance to oxygen transfer in biological processes was made, using an oxygen sensing microprobe. This instrument is an inert material coated long needle with an exposed sensing tip about 2 microns long and one micron wide, which can detect the local oxygen concentration and send signals to a picoammeter for readout and recording. The oxygen sensing microprobe was used in contaminated water to detect the existence of two transferring zones near a surfactant laden surface (the stagnant film zone and the penetrable zone) and to measure the frequency of surface renewal in clean water. A linear relationship was found between the square root of the renewal rate, 0.5, and the interfacial mass transfer coefficient, K sub L, which was predicted by the Danckwerts theory. Further work with the microprobe was recommended to allow direct experimental determination of the concentration profile of a transferring solute at a gas-liquid interface, and to provide information for further refinement of existing gas-liquid mass transfer theories. A clear understanding of the relationships involved in interfacial resistance to oxygen transfer is important because the rate of biological processes in aerobic fermentation and waste water treatment may be limited by them. (Beale-FIRL)
W76-03321

CORRELATION OF VARIOUS MONITORING ITEMS REGARDING POLLUTION SUBSTANCES OF HUMAN WASTES AND TREATED WATER (SHINYO TO SONO SHORISUI NO ODAKU SIBUN NI KANSURU KAKUSHU SOKUTEI KOMOKU KAN NO SOKAN NI TSUITE),
T. Nagasawa, N. Tanaka, and T. Yashima.
Kyotofu Eisei Kenkyusho Nenpo, (Annual Report of Kyoto Prefectural Institute for Public Health), p 83-90, March, 1975. 6 fig, 3 tab, 6 ref.

Descriptors: *Pollutant identification, *Monitoring, *Water pollution control, *Sewage, *Waste water treatment, Oxidation, Biochemical oxygen demand, Ammonia, Sedimentation, Activated sludge.

Correlations among various measured items for water released from the second oxidation tank and overflow water from the final sedimentation tank of a total oxidation treatment method and for overflow water from the final sedimentation tank of a digestion activated sludge method were studied. The measured items included BOD, evaporation residue (ER), ignition loss (IL), COD(30-min), COD(4-hr), albuminoid N (Alb-N), ammonial N(Ammon-N), Alb-N+Ammon-N, iodine demand (ID) and chloride ion. Close correlations were found between the COD(4-hr), ER, IL and chloride ion of the released water from the second oxidation tank. Other items also showed noticeable correlations. Smaller amounts of correlation were found between the measured items for the overflow water from the final sedimentation tank of the total oxidation method, and better correlations were found for the overflow water from the final sedimentation tank of the digestion activated sludge method. (Su-FIRL)
W76-03342

METAL CONCENTRATIONS IN THE SEWAGE, EFFLUENTS, AND SLUDGES OF SOME SOUTHERN ONTARIO WASTEWATER TREATMENT PLANTS,
Canada Centre for Inland Waters, Burlington, Ontario.
B. G. Oliver, and E. G. Cosgrove.
Environmental Letters, Vol 9, No 1, p 75-90, 1975. 4 tab, 17 ref.

Descriptors: Effluents, *Sewage, *Sludge disposal, *Waste water treatment, *Metals, *Treatment facilities, Trickling filters, Aeration, *Pollutant identification, Sludge digestion, Anaerobic digestion, Sewage sludge, Sewage treatment, Land, Activated sludge, Sewage effluents, Spectroscopy, Chemical analysis, Biological treatment, Water pollution sources, Domestic wastes, Industrial wastes, Water pollution.
Identifiers: Removal efficiencies, Metal concentrations.

Removal efficiencies by biological treatment of metals in raw sewage, effluents and sludges are discussed in terms of the effects on receiving waters and agricultural lands. Samples were collected at treatment plants and dissolved in acid and analyzed spectroscopically in the laboratory. The types of treatment plants studied were the conventional activated sludge system, the extended aeration system and the trickling filter system. Studies showed that the highest metallic content came from industrial waste waters, and in many cases certain metals could be traced to specific plants. Metal removal efficiencies for activated sludge plants were high except for some metals such as bismuth, nickel and strontium. This was due to the fact that most metals come out of solution when mixed with domestic waste waters, with the exception of these three. An extended aeration system showed about the same metal removal efficiency as the activated sludge plants, but the trickling filter system was slightly less efficient. The metals removed by the sewage treatment processes are heavily concentrated in the sludge. Anaerobic digestion under high temperatures reduces the volume and increases the metallic concentration. When this sludge is returned to the land there could be a detrimental effect on crop growth over a period of years. Improved guidelines must be developed before land application of sewage sludge can become an acceptable practice. (Pinto-FIRL)
W76-03343

CONTAMINATION OF THE DANUBE IN BRATISLAVA BY SEWAGE 2ND COMMUNICATION (DIE SALMONELLA-VERUNREINIGUNG DER DONAU DURCH ABWASSER IN BRATISLAVA 2. MITTEILUNG),
O. Kadlecova.
Zentralblatt fuer Bakteriologie, Parasitenkunde, Infektionskrankheiten und Hygiene, Vol 130, No 2, p 144-150, 1975. 4 tab, 18 ref.

Descriptors: Analytical techniques, Rivers, *Waste disposal, *Sewerage, *Pathogenic bacteria, *Salmonella, Sewers, Public health, Water pollution sources, *Pollutant identification.
Identifiers: Bratislava, *Danube River.

Samples were taken once per month for a one-year period to determine the occurrence of Salmonella in the main sewer of the city of Bratislava and in the Danube river 50, 100, and 200 meters below its outfall. The presence of Salmonella was analyzed in the 0.1, 1, 10, 50, 100, and 200 ml depths. In the 0.1 ml and one ml samples of the Danube water at all three distances below the outfall of sewage, Salmonella was detected. There were no seasonal differences found in the occurrence of pathogenic bacteria. Several tables illustrate the 623 strains of Salmonella that were isolated. These belonged to 6 serological groups, including 34 sero and lysotypes. The most frequent types found were S. paratyphi B, S. bareilly, S. typhi-murium, and S. anatum. The frequency of occurrence of Salmonella in the water samples was compared with their occurrence in humans and animals in the Bratislava area, and significantly more serological types were found in the water samples. (Kramer-FIRL)
W76-03344

A SUMMARY OF THE BIOGEOCHEMISTRY OF NITROGEN COMPOUNDS IN GROUND WATER,
California State Univ., Chico.
For primary bibliographic entry see Field 5B.
W76-03358

MONITORING AGRICULTURAL POLLUTION USING NATURAL FLUORESCENCE,
Saskatchewan Research Council, Saskatoon.
G. Lakshman.
Water Resources Research, Vol 11, No 5, p 705-708, October 1975. 9 fig, 1 tab, 7 ref.

Descriptors: *Monitoring, *Fluorescence, Analytical techniques, *Agricultural runoff, *Farm wastes, *Water pollution, Data collections, Measurement, Data transmission, Indicators, Pollutants, Water quality, *Pollutant identification, Fluorometry, Surface runoff, Organic compounds, Organic wastes, Nutrients, Sampling, Feed lots.

Identifiers: *Agricultural pollution, Bio-organic compounds, Soil samples, Runoff samples, Total carbon, Total organic carbon, Quantitative measurement, Luminescence, Turner fluorometer, Feedlot wastes, Mobile laboratory.

Many organic and bio-organic compounds exhibit natural fluorescence in the visible spectrum. In many cases this is strong enough to be used as a technique to monitor the presence of pollutants from animal wastes on land and in water. A number of soil and runoff samples from feedlot sites have been analyzed for the nature and stability of their natural fluorescence. A strong correlation exists between the fluorescence emission and the water quality parameters such as total carbon (TC), total organic carbon (TOC), and total inorganic carbon (TIC). It can be used in the quantitative measurement of agricultural pollution, and future research should help to exploit the technique for remote sensing applications. (Henley-ISWS)
W76-03387

INDEX OF SURFACE WATER QUALITY RECORDS TO SEPTEMBER 30, 1973, SOUTHEAST ALASKA,
Geological Survey, Anchorage, Alaska.
For primary bibliographic entry see Field 7C.
W76-03400

THE EXTRACTION OF OSMIUM WITH TRIBUTYL PHOSPHATE AND PHOTOMETRIC DETERMINATION WITH THIOUREA,
Indian Inst. of Tech., Bombay. Dept. of Chemistry.
S. Kalyanaraman, and S. M. Khopkar.
Analytica Chimica Acta, Vol 78, p 231-233, 1975. 1 tab.

Descriptors: *Heavy metals, *Photometry, *Analytical techniques, *Pollutant identification, Separation techniques, Phosphates.
Identifiers: *Osmium, Platinum group elements, Tributyl phosphate, Thiourea.

This method allows a quantitative separation of osmium from some platinum group elements. Osmium is extracted with tributyl phosphate (TBP) from 1-2M hydrochloric acid and determined photometrically as its complex with thiourea at 480 nm. Beer's law was obeyed over the concentration range 5-48 micrograms osmium per ml at 480 or 540 nm, the latter wavelength providing lower sensitivity. The molar absorptivity was 1,800 at 480 nm on the basis of osmium content. Quantitative extraction of osmium was possible only from 1-2M hydrochloric acid with 100% TBP. The concentration of the thiourea solution adequate for full color development was 1 ml of aqueous 5% thiourea solution in a total volume of 10 ml, which was then heated at 60C for 10 minutes to complete the color development. It is also possible to separate osmium from rhodium, iridium, and platinum, and to analyze binary and quaternary mixtures by this method. (Hoyle-Vanderbilt)
W76-03408

ANALYSIS OF FEED GRAINS AND FORAGES FOR TRACES OF COBALT BY FLAMELESS ATOMIC ABSORPTION SPECTROSCOPY,
Montana Dept. of Agriculture, Bozeman. Feed and Fertilizer Div.
L. Hageman, L. Torma, and B. E. Ginther.
Journal of the AOAC, Vol 58, No 5, p 990-994, September, 1975, 3 tab, 10 ref.

Descriptors: Analytical techniques, *Heavy metals, *Cobalt, Plant tissues, Feeds, *Pollutant identification, Spectroscopy, *Separation techniques.
Identifiers: *Atomic absorption spectroscopy.

Flameless atomic absorption spectroscopy (AAS) has been used for the analysis of cobalt (5-200 ppb) in plant material. An ashing temperature greater than 500 deg C causes some cobalt to be lost, and direct methods using the carbon rod atomizer were unsuccessful. Ca, Fe, Mg, and Mn can cause interference. An extraction technique using 1-nitroso-2-napthol as a chelating agent is recommended. Samples are dry ashed, dissolved in dilute HC1, and extracted with 1-nitroso-2-naphthol-chloroform, and the cobalt level is determined by AAS. (Hoyle-Vanderbilt)
W76-03410

FE-MN OXIDE COATINGS IN STREAM SEDIMENT GEOCHEMICAL SURVEYS,
Georgia Univ., Athens. Dept. of Geology.
For primary bibliographic entry see Field 5B.
W76-03412

THE EFFECTS OF DESALINATION BRINES ON CRASSOSTREA VIRGINICA (GMELIN),
Dow Chemical Co., Freeport, Tex. Texas Div.
For primary bibliographic entry see Field 5C.
W76-03414

NEW ENVIRONMENTAL HEALTH PROBLEMS IN WATER SUPPLY,
National Inst. of Environmental Health Services, Research Triangle Park, N.C.
For primary bibliographic entry see Field 5F.
W76-03425

CONTAMINANTS IN RAINWATER AND THEIR RELATION TO WATER QUALITY, PART II,
Suffolk County Dept. of Environmental Control, N. Y.
J. A. Frizzola, and J. H. Baier.
Water and Sewage Works, Vol 122, No 9, p 94-95, September, 1975. 1 fig, 1 tab, 15 ref.

Descriptors: *Water quality, *Groundwater, Precipitation(Atmospheric), Ions, Hydrogen ion concentration, Ammonia, Chlorides, Sulfur compounds, Water pollution.
Identifiers: *Groundwater contamination, Total acid effect(TAE), Scavenging acid effect(SAE).

Contaminants of rainwater are shown to have an effect on groundwater quality, by analysis of data collected at 3 stations on Long Island, New York. Background concentrations of 2 mg/liter total nitrogen enter groundwater as precipitation. Thus, when comparable concentrations are found in shallow groundwater they cannot be attributed to human pollution. Average values of ammonia concentration fit in with values from previous analyses in the northeastern United States. Ammonia can act to reduce acidity in rainwater, but since pH values of 4 or 5 are common, it seems the ammonia is either removed or dominated by stronger acid reactions. Sulfur compounds, especially sulfur dioxide formed from fossil fuel combustion, were found to be the predominant cause of acid precipitation over Long Island. Chloride/sodium ratios were less than the expected seawater values, perhaps as a result of the composite collection method. It is suggested that the term total acid effect (TAE) be used when discussing the composite sample and that scavenging acid effect (SAE) to be used to refer to pH obtained directly from natural precipitation. In this study, all ion concentrations in precipitation were reported higher at urban than at rural stations. (Beale-FIRL)
W76-03445

SIMULATION OF BOD AND DO BALANCE WITH RESPECT TO POLLUTED SHALLOW-RIVER (PART 2): SIMULATION EXAMPLE FOR MIDDLE COURSE TAMAGAWA (ASAI ODAKU KASEN NI OKERU BOD, DO SHUSHI NO SIMURASHON (DAI 2 HO): TAMAGAWA CHURYUIKI E NO TEKIYO REI),
For primary bibliographic entry see Field 5B.
W76-03446

A WATER CONDUCTIVITY RECORDER,
Commonwealth Scientific and Industrial Research Organization, Clayton (Australia). Div. of Chemical Physics.
G. F. Box, I. R. Dick, and P. D. Haines.
Australian Journal of Instrumentation and Control, Vol 31, No 4, p 67-72, July/August, 1975. 4 fig, 3 ref.

Descriptors: *Electrical conductance, *Monitoring, *Water quality, *Dissolved solids, Measurement, Instrumentation, Logging(Recording), Salinity, Surface waters, On-site tests, *Pollutant identification.

The design and development of an electronic instrument for measuring and recording the conductivity of surface waters is described. The instrument is designed for unattended field operation and is totally immersed in the water under test. A quartz-crystal-controlled solid state clock defines the sampling period, while a thermal printer records the measured conductivity values. A cast-aluminum housing contains the electronics with an inductive-type sensing head mounted below, inside a louvred plastic screen. The instrument has a temperature-compensated conductivity range of 0 - 17,600 microSiemen per cm with a resolution of 0.5% and a linearity of 1.0% of full scale. It has an unattended operating period of at least three months when sampling at a 12-hourly rate. (CSIRO)
W76-03453

INDUSTRIAL REQUIREMENTS FOR EFFECTIVE POLLUTION CONTROL. AUTOMOBILE INDUSTRY,
General Motors Corp., Warren, Mich. Environmental Activities Staff.
For primary bibliographic entry see Field 5G.
W76-03498

ION-SELECTIVE ELECTRODES IN ENVIRONMENTAL RESEARCH,
Missouri Univ., Columbia. Dept. of Chemistry.
S. E. Manahan, M. J. Smith, and K. M. Stelting.
In: Electrochemical Contributions to Environmental Protection, Theodore R. Beck, et al, editors. The Electrochemical Society, Inc., Princeton, New Jersey, 1972, p 50-56. 2 ref. OWRR A-049-MO(7).

Descriptors: *Ion exchange, *Electrodes, *Analytical techniques, Calcium, Fluorides, Nitrates, Sulfates, Monitoring, Copper, Monitoring, Copper, Chelation, Denitrification, Ammonia, Biodegradation, Metals, Enzymes, Electrochemistry, Pollutants, Cations, Water properties, Algae, Waste water treatment, *Pollutant identification.
Identifiers: *Ion-selective electrodes.

The two types of specific-ion electrodes --the liquid ion exchanger type such as calcium electrodes and the solid membrane such as the fluoride type-- can be used to determine fluoride, perchlorate, nitrate, sulfate, and EDTA. They are not interference-free specific sensors for analysis and monitoring pollutants in natural and waste waters, but can be used for fundamental studies of natural water. They respond to ion activities, not total concentrations, provide continuous monitoring, do not require sample treatment, can frequently be used in situ, and respond to species for which other sensors are unavailable. Nitrate electrodes can follow nitrate reactions in bacterial media but nitrate and Chlorella cells interfere. Copper electrodes can determine copper requirements for Oocystis, monitor copper removal, and should be applicable to complexation studies in natural and waste waters. It should be possible to use ion-selective electrodes to determine chelating agent strength, nitrate electrodes to study denitrification processes where nitrogen is produced from nitrate reduction in tertiary waste water treatment; ammonia electrodes to study decomposition of nitrogenous wastes to produce

ammonia; copper and cadmium electrodes to study biodegradation of chelates of these metals; and enzyme electrodes to study biologically active compounds in waste waters. (Buchanan-Davidson--Wisconsin)
W76-03499

THE APPLICATION OF SEMICONDUCTOR COMPOUNDS AS INDICATOR ELECTRODES,
Skopje Univ. (Yugoslavia). Center for Radioisotopes Application in Science and Industry.
P. Kirkov.
In: Electrochemical Contributions to Environmental Protection, Theodore R. Beck, et al., editors. The Electrochemical Society, Inc., Princeton, New Jersey, 1972, p 57-75. 9 fig, 60 ref.

Descriptors: *Electrical properties, *Electrodes, *Indicators, *Analytical techniques, Ions, Conductivity, Electrolytes, Aqueous solutions, Heavy metals, Potentiometers, Electrochemistry, *Pollutant identification.
Identifiers: *Semiconductor compounds, *Ion-selective electrodes.

Adequate conductivity is a serious problem in solid-type ion-selective electrode preparation. Impurities and degree of nonstoichiometry influence ion-selective electrode conductivity, independent of preparation method. Solid ion-selective electrodes are semiconductors or show semiconductor properties. Semiconductor compounds might be used as indicator electrodes for potentiometric determination of ion concentrations. Theory and applications of non-stoichiometrical oxide semiconductive compounds, used as indicator electrodes in electroanalytical measurements for simultaneous determination of mixed electrolyte concentrations in aqueous and non aqueous solutions, are discussed. The relation between concentrations of several single electrolytes and steady state potential of semiconductor oxides was derived from a boundary layer structure model with double layers on the solution and semiconductor sides. This was experimentally verified in aqueous solutions of heavy metals, carbon monoxide, carbon dioxide, sulfur dioxide, sulfur trioxide, halides, chromates, and phenol. Any semiconductor electrodes on whose surface there is favorable ion adsorption (especially n-type nonstoichiometric oxide semi-conductors) might be used for potentiometric measurements of ion concentration. A tin oxide and indium oxide n-type semiconductor electrode was used to determine ion concentration and surface active materials. (Buchanan-Davidson--Wisconsin)
W76-03500

5B. Sources Of Pollution

WATER QUALITY IN IOWA STREAMS: SUMMARY OF A CONFERENCE HELD MARCH 1975.
Iowa State Univ., Ames. Dept. of Animal Ecology.
For primary bibliographic entry see Field 5A.
W76-03004

CADMIUM IN PLANKTON: ELEVATED CONCENTRATIONS OFF BAJA CALIFORNIA,
Moss Landing Marine Labs., Calif.
J. H. Martin, and W. W. Broenkow.
Science, Vol. 190, No. 4217, p 884-885, November 1975. 2 fig, 10 ref.

Descriptors: *Plankton, *Metals, *Cadmium, Zooplankton, Detritus, Path of Pollutants, Sampling, Water pollution sources, Distribution patterns.
Identifiers: *Bioaccumulation, Baja California.

One hundred thirty-five plankton samples were collected in the northeast Pacific Ocean and analyzed for their cadmium content. Concentrations were generally low (2 to 5 micrograms of cadmium per gram, dry weight) in all samples, except for the plankton collected off Baja California, where high values (10 to 20 parts per million) were consistently found on two cruises. (Klein)
W76-03021

IMPACT OF SEWAGE ON THE DISTRIBUTION, ABUNDANCE AND COMMUNITY STRUCTURE OF ROCKY INTERTIDAL MACROORGANISMS,
California Univ., Irvine. Dept. of Population and Environmental Biology.
For primary bibliographic entry see Field 5C.
W76-03023

CADMIUM IN NEW ZEALAND DREDGE OYSTERS: GEOGRAPHIC DISTRIBUTION,
Marine Dept., Wellington (New Zealand). Fisheries Research Div.
S. A. Nielsen.
International Journal of Environmental Analytical Chemistry, Vol 4, p 1-7, 1975. 4 fig, 2 tab, 11 ref.

Descriptors: *Cadmium, *Mollusks, *Oysters, Metals, Geographical regions, *Distribution patterns, Water pollution sources.
Identifiers: *Ostrea lutaria, *Geographic distribution, Bioaccumulation, Tissue analysis, *New Zealand(Foveaux Strait).

High cadmium levels of up to 9 ppm wet weight were found in the dredge osyter, Ostrea lutaria, from Foveaux Strait, New Zealand. Average Cd levels in the oysters were determined at 24 stations to determine the geographic distribution of Cd. These data, in combination with a consideration of the prevailing currents, indicated that the Cd source lay in an area of no industrial pollution. Compared with other oyster species, O. lutaria was thought to have a predilection for accumulating Cd. (Klein)
W76-03025

FOULING COMMUNITY CHANGES INDUCED BY THE THERMAL DISCHARGE OF A HAWAIIAN POWER PLANT,
Hawaiian Electric Co., Inc., Honolulu. Environmental Dept.
For primary bibliographic entry see Field 5C.
W76-03028

ACUTE EFFECTS OF METHYL MERCURY TOXICITY IN CHANNEL CATFISH (ICTALURUS PUNCTATUS) KIDNEY,
Mississippi Univ., Jackson. Dept. of Anatomy.
For primary bibliographic entry see Field 5C.
W76-03044

SOME METHODOLOGY FOR APPRAISING CONTAMINANTS IN AQUATIC SYSTEMS,
Battelle-Northwest, Richland, Wash. Pacific Northwest Lab.
L. L. Eberhardt.
Journal of the Fisheries Research Board of Canada, Vol 30, No 10, p 1852-1859, 1975. 3 fig, 2 tab, 37 ref.

Descriptors: *Methodology, Technology, *Laboratory tests, Design, Toxicity, Wastes, DDT, Dieldrin, Toxins, Absorption, Retention, Equations, Kinetics, Model studies.
Identifiers: *Kinetic models, Bioaccumulation.

Kinetic models for uptake and retention of various contaminants by aquatic biota were recommended as useful means of summarizing and intercomparing laboratory studies, and as essential tools in analyzing field data. Some simple models were fitted to laboratory data on the uptake and retention of DDT and dieldrin by fish. The relation between metabolic rate and body size was used to appraise data and concentrations of DDT, PCB's and mercury in fish. Evidence suggested that uptake and retention experiments performed on small fish gave very different results from those expected on individuals important in sports or commercial fisheries. (Klein)
W76-03048

STUDIES OF TOLERANCE TO HEAVY METALS IN THE FLORA OF THE RIVERS YSTWYTH AND CLARACH, WALES,
University Coll. of Wales, Aberystwyth. Dept. of Botany and Microbiology.
For primary bibliographic entry see Field 5C.
W76-03053

EFFECT OF SOUTH LOUISIANA CRUDE OIL AND NO. 2 FUEL OIL ON GROWTH OF HETEROTROPHIC MICROORGANISMS, INCLUDING PROTEOLYTIC, LIPOLYTIC, CHITINOLYTIC AND CELLULOLYTIC BACTERIA,
Maryland Univ., College Park. Dept. of Microbiology.
For primary bibliographic entry see Field 5C.
W76-03054

A STUDY OF THE INTERTIDAL MACROFAUNA AROUND THE BP REFINERY (KENT) LIMITED,
City of London Polytechnic (England). Dept. of Biological Sciences; and Sir John Cass Coll., London (England). School of Science and Technology.
J. R. Wharfe.
Environmental Pollution, Vol 9, p 1-12, 1975. 7 fig, 3 tab, 14 ref.

Descriptors: *Speciation, *Seasonal, *Wildlife, *Mud flats, Intertidal areas, Annelids, Bivalves, Sampling, Oil, Water quality, Sediments, Water pollution sources, Estuaries.
Identifiers: Nereis diversicolor, Peloscolex benedeni, Petroleum refineries, England, Medway estuary.

A study of the species composition and seasonal quantitative estimates of the mud flat fauna of the lower Medway estuary revealed the complete absence of bivalves and a reduction in the number of annelids, particularly Nereis diversicolor and the tubificid Peloscolex benedeni, around the foreshore of the BP Refinery (Kent) Limited. Cores taken for particle size analysis, oil content, organic matter, redox potentials and free sulphide ion levels showed the extent of the effects to be restricted to an area approximately 1 1/2 km in either direction from the refinery outfall. Possible causes of the effects shown were discussed. (Klein)
W76-03055

A LABORATORY INVESTIGATION OF THE EFFECT OF SURFACE FILMS ON WIND INDUCED REAERATION,
Massachusetts Univ., Amherst. Water Resources Research Center.
D. C. Knudson, and P. A. Mangarella.
Available from the National Technical Information Service, Springfield, Va 22161, as PB-248 462, $5.50 in paper copy, $2.25 in microfiche. Pub No 54, August 1975. Completion Report FY-76-1, 99 p, 27 fig, 60 ref, 2 append. OWRT A-056-MASS (1). 14-31-0001-4021.

Descriptors: *Reaeration, Thin films, Wind velocity, Measurement, Dissolved oxygen, *Regression analysis, Surfactants, *Electrolysis.
Identifiers: *Surface films, *Electorly tie reduction.

The effect of surface films on wind induced atmospheric reaeration of standing water was studied in a series of laboratory experiments. Measurements were made of reaeration into a small pool of water recessed into the floor of a wind tun-

nel at wind speeds from 3.8 m/s to 7.2 m/s, with and without a soluble surfactant in the water. An unusual measurement technique was employed which involved the unsteady state electrolytic reduction of dissolved oxygen at a silver cathode immersed in the water, and a regression analysis of the current-time data to obtain the reaeration coefficient, K.L
W76-03100

A NUMERICAL MODEL OF DROPLET ENTRAINMENT FROM A CONTAINED OIL SLICK,
Mount Auburn Research Associates, Inc., Newton Upper Falls, Mass.
R. G. Zalosh.
Available from the National Technical Information Service as AD-A006 600, 5.00 in paper copy, $2.25 in microfiche. Report No CG-D-65-75, September 1974. 76 p, 14 fig, 16 ref, 3 append. DOT-CG-41822-A.

Descriptors: *Oil spills, *Oil pollution, *Water pollution, Water pollution control, Oil, Oily water, Mechanical properties, Hydraulics, Model studies, Mathematical models, Currents(Water), Waves(Water), Drops(Fluids), Entrainment, Computer programs.

A theoretical analysis of oil droplet entrainment from a contained oil slick moving relative to water has been performed as a function of relative oil-water velocity. A numerical method incorporating discrete vortices was used to calculate smooth stable headwave profiles at low velocities and unstable profiles at high velocities. An oil droplet formation criterion was formulated and applied to the numerically modeled headwave region. The computed critical velocity corresponding to the onset of significant droplet entrainment was in close agreement with recent laboratory measurements. The cmputed entrainment rates were in approximate agreement with experiment, but did not exhibit systematic variation with water current. Oil drop trajectories were calculated using realistic starting conditions, but the work did not extend beyond the first intersection of the drop with the slick. Recommendations were given for extending the work to include: post-information droplet dynamics, wave effects, turbulence effects, and barrier design changes. Computer program listings were contained in an appendix. (Sims-ISWS)
W76-03102

ENVIRONMENTAL STATUS OF THE LAKE MICHIGAN REGION, VOLUME 2. PHYSICAL LIMNOLOGY OF LAKE MICHIGAN.
For primary bibliographic entry see Field 2H.
W76-03105

PART 2. DIFFUSION AND DISPERSION,
Woods Hole Oceanographic Institution, Mass.
G. T. Csanady.
Environmental Status of the Lake Michigan Region, Volume 2. Physical Limnology of Lake Michigan, Report No ANL/ES-40, Volume 2, Argonne National Laboratory, Illinois, p 103-121, June 1975. 8 fig, 10 ref.

Descriptors: *Lake Michigan, *Dispersion, *Diffusion, *Disposal, Pollutants, Water pollution, Circulation, Water circulation, Currents(Water), *Path of pollutants, Stochastic processes, Mixing, Lakes.

The local concentration of a conservative pollutant in Lake Michigan depends on the rate at which some discharged batch mixes with ambient waters and thereby expands in size. The physical mechanism of such growth of pollutant-batches was discussed in terms of several theoretical models which have appeared in the literature over the years, in order to throw light on the important processes involved in pollutant disposal. Simple means of estimating pollutant concentration were then briefly described, to allow the assessment of nuisance or hazard associated with the release of pollutants in the lake. (See also W76-03105) (Sims-ISWS)
W76-03107

SEASONAL CHARACTERISTICS OF WATER MASSES IN MUIR INLET, A FJORD WITH TIDEWATER GLACIERS,
Alaska Univ., College. Inst. of Marine Science.
For primary bibliographic entry see Field 2L.
W76-03112

DETERMINING OPTIMAL WELL DISCHARGE,
Colorado State Univ., Fort Collins.
For primary bibliographic entry see Field 4B.
W76-03118

FLUOMETURON AND WATER CONTENT DISTRIBUTIONS DURING INFILTRATION: MEASURED AND CALCULATED,
Oklahoma State Univ., Stillwater. Dept. of Agronomy.
A. L. Wood, and J. M. Davidson.
Soil Science Society of America Proceedings, Vol 39, No 5, p 820-825, September-October 1975. 7 fig, 1 tab, 20 ref. EPA R-800364.

Descriptors: *Path of pollutants, Pollutant identification, *Adsorption, *Herbicides, *Dispersion, *Infiltration, Laboratory tests, Numerical analysis, Soil moisture.
Identifiers: *Fluometuron, *Adsorption-desorption, Miscible, Displacement, Water content, Cobb sand, Boundary conditions, Numerical dispersion.

Laboratory columns of Cobb sand were used to study the movement and distribution of surface applied 1,1-dimethyl-3-(a,a,a,-trifluoro-m-tolyl) urea (fluometuron) for three infiltration rates and two initial soil-water contents. Fluometuron movement showed little dependence on initial soil-water content for a given infiltration rate. Experimental data indicated that equilibrium existed between the adsorbed and solution phases for all infiltration rates and initial soil water contents studied with the exception of the ponded infiltration into air-dry soil case. A simultaneous numerical solution of the water and solute transport equations described a fluometuron pulse, for large infiltration rates, which lagged the experimental data. The agreement between calculated and measured distributions was improved when the infiltration rate was reduced. The shape of the fluometuron pulse was reasonably well described by the mathematical model. (Roberts-ISWS)
W76-03123

APPLICATION OF THE WIND EROSION EQUATION IN AIR POLLUTION SURVEYS,
For primary bibliographic entry see Field 5A.
W76-03125

WATER QUALITY IN A TROPICAL RAIN FORESTED CATCHMENT,
University of New England, Armidale (Australia). Dept. of Geography.
N. D. Turvey.
Journal of Hydrology, Vol 27, No 1/2, p 111-125, October 1975. 4 fig, 7 tab, 34 ref.

Descriptors: *Water quality, *Tropical regions, *Rain forests, *Dissolved solids, *Suspended solids, *Discharge(Water), Watersheds(Basins), Model studies, Calcium, Sodium, Potassium, Magnesium, Silica, Water pollution.
Identifiers: *Papua New Guinea, *Mass balance equation, *Mixing model, Bristol gage, Silicon dioxide.

Examined were the variations of Ca, Na, K, Mg, SiO2, dissolved-solids, and suspended-solids concentrations with discharge in a small rain-forested catchment in Central Papua. The mass-balance approach to mixing models was examined and it was considered that this can be used to predict water-quality variability, but it does not necessarily provide a mathematical explanation of the dilution process. Log-log and semi-log transformations of the data provided correlations close to those of the mixing model. The results obtained indicate a need for more water-quality data for areas of tropical rain forest which are to be developed, because this information can be related to catchment disturbance and used as a measure of nutrient loss from the ecosystem. Comparisons were made with other tropical and extra-tropical water-quality data. (Lardner-ISWS)
W76-03132

MOVEMENT OF HERBICIDES IN SOIL BY MASS FLOW,
Iowa State Water Resources Research Inst., Ames.
H. P. Johnson, and J. L. Baker.
Available from the National Technical Information Service, Springfield, Va 22161 as PB-248 455, $4.00 in paper copy, $2.25 in microfiche. Completion Report, Iowa State Water Resources Research Institute No 66, June 1975. 35 p, 5 fig, 6 tab, 23 ref, 1 append. OWRT A-043-IA(1). 14-31-0001-3515/3815/4015.

Descriptors: *Path of pollutants, Pollutant identification, *Herbicides, Movement, *Soil types, *Unsaturated flow, *Mathematical models, Temperature, Soil density, Diffusion, Gas chromatography, Chemical properties, Physical properties, Iowa.
Identifiers: *Mass flow, Alachlor, Atrazine, Cyanazine, Percent moisture differences, Diffusion coefficient, Multiple linear regression, Diffusion cells.

The dominant factors in the movement of selected herbicides in soil by mass flow under unsaturated conditions are temperature, percent moisture differences, soil type, and at higher temperatures, soil density. Both increasing temperature and increasing moisture differences increased movement by what was believed to be mass flow. Soil type, by affecting the degree of herbicide adsorption, affected movement by mass flow. The higher porosity at lower density and thus greater vapor phase movement is believed responsible for higher diffusion coefficients for 0 and +12% differences at 43.3 degrees. The time of diffusion had no measurable effect on the rate of movement. Of the three herbicides studied at 1.3 gm/cc bulk soil density, only the diffusion rate for alachlor was measurably affected by the simultaneous movement of water. For both atrazine and cyanazine, movement was moisture independent. At 0.9 gm/cc the diffusion rate for alachlor, and at 43.3 C, for atrazine, was affected by the simultaneous movement of water. No measurements were made of cyanazine at 0.9 gm/cc. Because the data did not indicate that Fick's law was violated, an equation presented by Crank (1956) can be used to predict the movement in soil of the herbicides studied. This equation is based on the diffusion coefficient, D, which was shown in this study to be a function of temperature and moisture differences. in order to obtain D over a range of values for these variables, a multiple regression analysis was performed and regression coefficients determined.
W76-03134

UNCONVENTIONAL NUCLEAR POWER PLANT SITING OPTIONS AND WATER RESOURCE IMPACTS,
Connecticut Univ., Storrs. Inst. of Water Resources.
For primary bibliographic entry see Field 5G.
W76-03135

PHENOLS IN THE CLARK FORK RIVER,
Montana Univ., Missoula. Dept. of Chemistry.
R. E. Erickson, C. Bardwell, and J. Sosebee.
Available from the National Technical Information Service, Springfield, Va 22161 as PB-248 673, $3.50 in paper copy, $2.25 in microfiche. Research Report No 71, Montana University Joint Water Resources Research Center, Bozeman, September 1975. 11 p, 1 fig, 8 ref. OWRT A-082-MONT(1).

Descriptors: *Phenols, *Organic compounds, *Industrial wastes, Water chemistry, *Water quality, Effluents, *Montana, *Path of pollutants, Water pollution sources, Pollutant identification.
Identifiers: *Clark Fork River(Mont), Fish quality.

The objective was to determine the nature and amounts of phenols in the Clark Fork River. These compounds, which are a natural part of the effluent of Kraft pulp mills and are discharged every Spring into the Clark Fork, are known to be toxic of high concentrations to some species and to impair the flavor of fish at very low concentrations. The standard method for determining phenols was likely to be unsuitable for determining the type of phenols found in pulp mill effluent. An added objective was, therefore, to compare the standard method with a more sophisticated gas chromatographic technique for the analysis of phenols. The effluent from the Hoernor Waldorf mill contains a number of phenolic compounds. Gas chromatographic separation of a concentrated solution (5% carbowax 20 M TPA on Gas Chrom Q100/120 column) followed by mass spectroscopy revealed seventeen different compounds in the phenolic fraction, only two of which, p-cresol and propyl phenol were positively indentified. p-Cresol was found to be in the largest single concentration (37% of the phenolic fraction). The mill is now using secondary treatment on their effluent, which should lower their phenolic content (effluent in settling ponds contained 360 ppb phenols by the Standard Methods analysis in December, 1973). However, some caution must be exercised because two other factors--frequent shutdowns of the plant during 1975 and relatively high flow of the Clark Fork throughout the year--would tend to lower the concentration of phenolic compounds in the river.
W76-03136

CONTROL OF NITROGEN TRANSFORMATIONS IN SOILS,
Iowa State Univ., Ames. Dept. of Agronomy.
L. G. Bundy.
Available from the National Technical Information Service, Springfield, Va 22161 as PB-248 730, $5.00 in paper copy, $2.25 in microfiche. Ph D Dissertation, 1973. 76 p, 3 fig, 17 tab, 41 ref. OWRT A-041-IA(2).

Descriptors: *Nitrogen, *Soils, *Fertilizers, Nitrification, Hydrolysis, Nitrogen compounds, Ureas, Inhibitors, Inhibition, Water pollution control, Water pollution sources, Chemistry, Soil chemistry.
Identifiers: *Nitrogen transformations.

Compounds that can effectively retard nitrification and urea hydrolysis in soils are clearly desirable because nitrate formed by nitrification of nitrogen fertilizers applied to soils undoubtedly contributes to nitrate pollution of water resources, and most of the problems associated with the use of urea as a fertilizer result from the rapid hydrolysis of urea by soil urease. The effectiveness of the nitrification inhibitors studied was markedly affected by soil type, soil temperature, and substitution of urea for ammonium sulfate as the source of nitrifiable nitrogen. Most of the inhibitors were considerably more effective at 15C than at 30C. Studies of the effects of three patented nitrification inhibitors (N-Serve, ATC, and CL-1580) on transformations of urea N in soils showed that these compounds had little, if any, effect on urea hydrolysis but greatly retarded nitrification of the ammonium formed by urea hydrolysis and markedly increased gaseous loss of urea N as ammonia. Studies of the effects of 10 urease inhibitors on nitrification of ammonium in soils showed that most of these inhibitors had little effect on nitrification when applied at the rate of 10 microgram/g of soil. (Sims-ISWS)
W76-03141

HEAT ASSIMILATIVE CAPACITY OF THE SANGAMON RIVER,
Illinois State Water Survey, Urbana.
C. T. Yang, and J. B. Stall.
Available from the National Technical Information Service, Springfield, Va 22161 as PB-248 674, $4.00 in paper copy, $2.25 in microfiche. University of Illinois Water Resources Center Research Report No 104, September 1975. 31 p, 11 fig, 4 tab, 15 ref, 1 append.

Descriptors: *Thermal capacity, *Rivers, *Powerplants, *Illinois, Temperature, Water temperature, Costs, Heat transfer, Watersheds(Basins), Hydraulic properties, *Thermal pollution, *Waste assimilative capacity.
Identifiers: *Sangamon River(Ill).

A standard procedure for determining the distribution and variation of the heat assimilative capacity of a river has been developed. Hydraulic geometry equations for the Sangamon River Basin were used to provide the necessary hydraulic information. The study indicated that the total heat assimilative capacity of a river depends on the location of power plants, residual temperature, flow frequency, and seasonal variation of water temperature and wind speed. Water temperature data from 18 gaging stations in the Sangamon River Basin and wind speed data from 5 weather stations in or near the basin were used to determine the surface transfer coefficient for excess heat along the Sangamon River. This coefficient can be approximated by four equations for different ranges of wind speed. An analysis of the cost-capacity relationships for 29 power plants indicated that the cost per kilowatt of power output decreases with increasing power plant capacity. (Sims-ISWS)
W76-03142

MODELS OF LAND AND WATER ALLOCATION TO IMPROVE ENVIRONMENT AND WATER QUALITY THROUGH SOIL LOSS CONTROLS,
Iowa State Univ., Ames. Center for Agricultural and Rural Development; and Iowa State Univ., Ames. Dept. of Economics.
For primary bibliographic entry see Field 5G.
W76-03164

A PROXIMATE BIOLOGICAL SURVEY OF SAND DIEGO BAY, CALIFORNIA,
Naval Undersea Center, San Diego, Calif.
For primary bibliographic entry see Field 5C.
W76-03170

PESTICIDE DEGRADATION BY MARINE ALGAE,
Wisconsin Univ., Madison. Dept. of Entomology.
For primary bibliographic entry see Field 5C.
W76-03174

ANNUAL SUMMARY OF RESEARCH RESULTS FOR FISCAL YEAR 1974, MESA NEW YORK BIGHT PROJECT.
National Oceanic and Atmospheric Administration, Boulder, Colo. Marine Ecosystems Analysis Program Office.
For primary bibliographic entry see Field 2L.
W76-03186

PREDICTIVE MODEL FOR PHOSPHORUS IN LAKES,
North Carolina Univ., Chapel Hill. Dept. of Environmental Sciences and Engineering.
W. J. Snodgrass, and C. R. O'Melia.
Environmental Science and Technology, Vol 9, No 10, p 937-944, October, 1975. 7 fig, 3 tab, 41 ref.

Descriptors: *Lakes, *Mathematical models, *Phosphorus, *Water management(Applied), Water quality control, Sewage treatment, Waste disposal, Model studies, Detergents, Forecasting.
Identifiers: Hydraulic loading, Phosphorus loading, Mean depth.

An input-output model has been developed to predict phosphorus in lakes. The purpose of this research was to formulate and verify such a model for decisionmaking in management of lake water quality and to determine causes for inverse relationships between several lake conditions and mean lake depth. A few previous models, both empirical and conceptual, were described. The proposed model showed excellent agreement between observed and predicted average phosphorus concentrations for lakes with a wide range of hydraulic detention times (one to 700 years) and mean depths (14 to 313 meters). Presently, the model is limited to lakes with aerobic hypolimnetic waters. Minimum data required for prediction are phosphorus loading, hydraulic loading, and mean depth. The model can be applied to determining the eventual response of a lake to a proposed change in phosphorus inputs, such as the result of removal from detergents or by sewage treatment. The verification of the model's temporal response characteristics indicates that it can be used to predict the rate of changes which will occur in a lake following a change in P inputs. Thus, the model might be used to evaluate management alternative such as mixing, hypolimnetic aeration, and hypolimnetic withdrawal. Experimental evidence for a depth-dependent exchange of heat and materials across the thermocline region of lakes as well as for natural flocculation of particulate matter in the lakes was also presented. (Kramer-FIRL)
W76-03243

PRIVATE CONSTRAINTS ON GROUNDWATER CONTAMINATION,
Virginia Polytechnic Inst. and State Univ., Blacksburg. Water Resources Research Center.
For primary bibliographic entry see Field 4B.
W76-03244

DISTRIBUTION AND BIOMAGNIFICATION OF HEXACHLOROPHENE IN URBAN DRAINAGE AREAS,
North Carolina Univ., Chapel Hill. Dept. of Environmental Sciences and Engineering; and North Carolina Univ., Chapel. Hill School of Public Health.
J. L. Sims, and F. K. Pfaender.
Bulletin of Environmental Contamination and Toxicology, Vol 14, No 2, p 214-220, August, 1975. 2 fig, 1 tab, 10 ref.

Descriptors: *Pollutant identification, Water pollution sources, *Chemical wastes, Treatment facilities, Environmental effects, Public health, North Carolina, *Path of pollutants, *Distribution patterns, Organic wastes.
Identifiers: *Hexachlorophene, *Biomagnification, Hospital wastes.

A study was performed to determine the presence of hexachlorophene (HCP) in the waterways of the Upper Haw River Basin near Greensboro, North Carolina. The distribution data indicate that the two area waste water treatment plants are the major sources of HCP. Hospitals are probably the most significant sources of HCP to the treatment facilities. The organisms collected during the study all showed HCP concentrations significantly higher than those found in the water or sediment. Considerable biomagnification seems to be occurring in the water scavengers, crayfish and water boatmen. The HCP levels found in the water and

sediment do not represent a direct danger to human health and are not toxic to environmentally significant microorganisms. However, the evidence for the biomagnification of HCP from the low concentrations in water to potentially toxic levels warrants a more detailed study of the extent and effects of HCP contamination of the environment. (Orr-FIRL)
W76-03248

FATE OF WASTEWATER PHOSPHORUS IN SOIL,
Robert S. Kerr Environmental Research Lab., Ada, Okla. Water Quality Control Branch.
C. G. Enfield, and B. E. Bledsoe.
Journal of the Irrigation and Drainage Division Proceedings of ASCE, Vol 101, No IR3, p 145-155, September, 1975. 5 fig, 1 tab, 18 ref.

Descriptors: *Phosphorus, *Phosphorus compounds, *Soil management, Eutrophication, Sorption, Waste water disposal, Environmental effects, Analytical techniques, Pollutant identification, Land management.

The effects of applied phosphorus to a land application waste water treatment system were considered. Because phosphorus concentrations entering surface water must be low enough to avoid an accelerated eutrophication rate, both the amounts of residual phosphorus in the soil solution and the soil's ability to sorb applied phosphorus must be known. It proved possible to quantitatively project the minimum residual concentration of phosphorus in the soil solution by studying the solubility products of the more important compounds of aluminium, iron and calcium. The potential maximum of phosphorus able to be sorbed by a soil was examined in relation to a mass balance equation and various sorption models. Prediction of phosphorus concentration versus time and space for a given set of initial and boundary conditions was made by measurement of a time dependent sorption isotherm used with a mass balance analysis. (Beale-FIRL)
W76-03250

FATE OF WASTEWATER BACTERIA AND VIRSUSES IN SOIL,
Baylor Coll. of Medicine, Houston, Tex. Dept. of Virology and Epidemiology.
C. P. Gerba, C. Wallis, and J. L. Melnick.
Journal of the Irrigation and Drainage Division Proceedings of ASCE, Vol 101, No IR3, p 157-174, September, 1975. 5 tab, 63 ref.

Descriptors: *Waste water treatment, *Waste disposal, *Sewage disposal, *Microorganisms, Bacteria, Viruses, Groundwater, Surface waters, Water pollution effects, Laboratory tests, Soil analysis, Organic matter, Flow rates, Adsorption, Public health, Bibliographies.

With increasing use of land application for domestic waste water disposal, mechanisms involved in the removal of microorganisms present in the soil must be understood to minimize possible public health problems. A review of current research on the fates of bacteria and viruses in the soil is presented. Results of both laboratory and field tests for various microorganisms were described. In most cases, it appeared that the survival of bacterial pathogens in soil is limited to less than 2-3 months in temperature climates. However, application of sewage in the long range could result in their accumulation at the soil surface where they will be concentrated. Runoff from such areas must be controlled so as not to pollute surface waters. The survival of enteric bacteria in soil is dependent upon soil moisture content, temperature, pH, and nutrient availability. Bacteria removal seems to occur primarily at or near the soil surface by straining as well as by sedimentation and adsorption. Removal of viruses occurs largely by adsorption; degree of retention of viruses by soil particles is influenced by salt concentration, pH, presence of organic matter, flow rates, and the chemical composition of the soil. Because laboratory studies on viral and bacterial movement through soil are conducted under relatively constant conditions, they should be evaluated very carefully. (Kramer-FIRL)
W76-03251

THE NUMBER, GENERATION TIME AND PRODUCTION OF BACTERIA IN THE VOLGA AND ITS RESERVOIRS IN 1970, (IN RUSSIAN),
V. M. Kudryavtsev.
Mikrobiologiya, Vol 42, No 1, p 141-147, 1973, Illus. English summary.

Descriptors: *Rivers, *Reservoirs, *Bacteria, Biomass, Carbon dioxide, Water pollution sources.
Identifiers: Heterotrophic assimilation, USSR(Volga River), Ivanov method.

The total bacterial number in the Volga for a distance of over 3000 km for Kalinin to Astrakhan USSR in 1970 was ca. 2,400,000 - 3,600,000 per ml in May-June and 1,600,000 - 3,100,000 per ml in Sept.-Oct. The growth rate of the total bacterial number, calculated by heterotrophic assimilation of CO2, was 1.4 times in the summer and 1.3 times in the autumn higher than that determined by the Ivanov method. Heterotrophic assimilation of CO2 by the bacateria was ca. 2.2-7.7 micrograms/cal/1/day in May-June and decreased almost twofold in Sept.-Oct. The daily value of the bacterial biomass production was 36.7-128.0 micrograms/cal/l after the summer floodtime and 18.3-68.4 micrograms/cal/l in the autumn.--Copyright 1974, Biological Abstracts, Inc.
W76-03262

EFFECT OF FALLOUT OF WINDBRONE ZINC, LEAD, COPPER AND CADMIUM FROM A FUMING KILN ON SOIL GEOCHEMICAL PROSPECTING AT BERG AUKAS, SOUTH WEST AFRICA,
Cape Town Univ., South Africa. Dept. of Geochemistry.
J. W. Marchant.
Journal of Geochemical Exploration, Vol 3, No 1, p 191-198, March 1974. 2 fig, 3 tab, 6 ref.

Descriptors: *Heavy metals, *Soil contamination, *Soil analysis, *Geochemistry, *Air pollution effects, Leaching, Soil profiles, Zinc, Lead, Copper, Cadmium, Path of pollutants.
Identifiers: Windborne metals, Geochemical exploration, Fuming kilns.

A study has been made of the vertical and lateral extent of soil contamination due to windborne metal-rich dust from a recently erected fuming kiln. Zn and Pb fallout was detectable for several kilometers from the plant, and the distribution pattern is clearly wind controlled. Zn and Pb contamination, even when present in thousands of parts per million on surface, has not yet penetrated to 10 cm depth in the soil. Subsequent sampling for geochemical prospecting purposes has thus been done at 30 cm depths and is contamination free. Cu and Cd distributions due to fallout of these metals was found to be insignificant. It is possible that long term leaching of these metals and progressive downward migration will slowly contaminate the entire soil profile. (Hoyle-Vanderbilt)
W76-03302

MAJOR AND TRACE ELEMENT ANOMALIES IN STREAM SEDIMENTS OF THE TEIGN VALLEY OREFIELD,
Southampton Univ. (England). Dept. of Geology.
For primary bibliographic entry see Field 5A.
W76-03303

AN ELECTRON MICROSCOPE AUTORADIOGRAPHIC INVESTIGATION OF THE ACCUMULATION OF ZINC-65 BY A SPECIES OF EUTREPTIA,
Adelaide Univ., (Australia). Dept. of Botany.
For primary bibliographic entry see Field 5A.
W76-03308

A FOOD CHAIN MODEL OF CADMIUM IN WESTERN LAKE ERIE,
Manhattan Coll., New York.
R. V. Thomann, D. S. Szumski, D. M. Di Toro, and D. J. O'Connor.
Water Research Vol 8, p 841-849, 1974. 5 fig, 3 tab, 9 ref.

Descriptors: *Food chains, Model studies, *Cadmium, Tracers, *Biomass, *Lake Erie, *Trophic level, Statistical methods, *Statistical models.
Identifiers: Food chain models.

The spatial-trophic level structure of this model demonstrates the increase in concentration and general behavior, when released into the water environment, of potentially toxic substances, such as cadmium, as one proceeds up the food chain of Western Lake Erie. The increase results from two factors: the decrease in total biomass at higher trophic levels and the decrease in the uptake rate. The food chain model illustrates how interactive modeling between complex non-linear and linear compartment models can be accomplished. The problems of verification of data availability are highlighted by the model: estimates of transfer rates and biomass of different trophic levels must be on hand. As an example of a modeling structure still in an early stage of development, the reliance is on linear kinetics rather than possibly more realistic non-linear mechanisms. (Hoyle-Vanderbilt)
W76-03310

MINE DRAINAGE POLLUTION REDUCTION BY INHIBITION OF IRON BACTERIA.
Harvard Univ., Cambridge, Mass. Lab. of Applied Microbiology.
For primary bibliographic entry see Field 5G.
W76-03314

THE UTILISATION OF SEWAGE SLUDGE,
For primary bibliographic entry see Field 5D.
W76-03328

CONTAMINATION OF THE DANUBE IN BRATISLAVA BY SEWAGE 2ND COMMUNICATION (DIE SALMONELLA-VERUNREINIGUNG DER DONAU DURCH ABWASSER IN BRATISLAVA 2. MITTEILUNG),
For primary bibliographic entry see Field 5A.
W76-03344

WASTE-PRODUCT POLLUTION OF BODIES OF WATER AND WASTE-WATER PURIFICATION,
P. E. M. Schneider.
Available from the National Technical Information Service, Springfield, Va 22161, as N74-33858, $4.00 in paper copy, $2.25 in microfiche. NASA Technical Translation NASA TT F-15,934, September, 1974. 28 p, 34 ref. Translated from Max-Planck-Institut fuer Stroemungsforschung, Goettongen, West Germany, Report 2/1974, 53 p.

Descriptors: *Waste water treatment, *Water pollution, *Bodies of water, *Reviews, Currents, Rivers, Lakes, Oceans, Self-purification.

A literature review is presented on the problems of pollution of water bodies by wastes, and on waste water purification. The review is intended to provide examples of problems involved in water pollution and the treatment of water, and to encourage the formulation of further questions. Currents in bodies of waters are important in the self-

purification of the water. Oxygen dissolved at the surface of waters is transported by turbulent exchange and convection to deeper water, therefore, the quantity of oxygen available to organisms at these deeper levels which participate in self-purification is a function of current conditions. Discussion is presented on the seven categories of water pollution: solid, liquid, gaseous, thermal, photo, chemical, and biological. These types of pollution can be corrected by solid, liquid, gaseous, thermal, photo, chemical, and biological purification methods. The quality of general-purpose and potable water decreases with time because only part of the pollutants are removed by present purification methods. Surface waters in lakes and rivers must be used as additional water purifiers in the future. Studies on currents in rivers, lakes, and oceans and their possibilities for the maintenance and improvement of good river and potable water supplies are being planned. (Orr-FIRL)
W76-03352

A SUMMARY OF THE BIOGEOCHEMISTRY OF NITROGEN COMPOUNDS IN GROUND WATER,
California State Univ., Chico.
J. Behnke.
Journal of Hydrology, Vol 27, No 1/2, p 155-167, October 1975. 4 fig, 1 tab, 55 ref.

Descriptors: *Nitrogen compounds, *Nitrates, *Water quality, *Groundwater, *Nitrogen cycle, *Biochemistry, Ammonia, Nitrites, Fertilizers, Inorganic compounds, Nitrogen, Monitoring, Measurement, Data collections, Agricultural chemicals, Surface runoff, Water chemistry, Water pollution, Path of pollutants, Water pollution sources.
Identifiers: Chemical data, Agricultural practices, Shallow aquifers.

The biogeochemistry of nitrogen compounds in groundwater is exceedingly complex. The exclusive chemical monitoring of nitrates in groundwaters is overly simplistic and may lead to errors in data interpretation. Nitrogen compounds are biodegradable, and an understanding of the physical, chemical, and biologic systems through which transient water is moving is important in analyzing chemical data. Groundwater nitrate contamination is generally encountered in shallow aquifers which have direct or indirect hydraulic continuity with the ground surface. Surface sources of groundwater nitrate contamination related to man's activities include domestic sewage, agricultural practices, and high-density animal confinement. (Henley-ISWS)
W76-03358

HEXAVALENT CHROMIUM IN THE GROUND WATER IN PARADISE VALLEY, ARIZONA,
Delaware Univ., Newark. Water Resources Center.
For primary bibliographic entry see Field 4B.
W76-03364

A NUMERICAL MODEL OF THE CIRCULATION IN CIENFUEGOS BAY, CUBA,
Kiel Univ. (West Germany). Institut Fuer Meereskunde.
For primary bibliographic entry see Field 2L.
W76-03374

PB-210 IN PRECIPITATION IN JAPAN AND ITS IMPLICATION FOR TRANSPORT OF CONTINENTAL AERSOLS ACROSS THE OCEAN,
Hokkaido Univ., Hakodate (Japan). Faculty of Fisheries; and Hokkaido Univ., Sapporo (Japan). Dept. of Chemistry.
K. Fukuda, and S. Tsunogai.
Tellus, Vol 27, No 5, p 514-521, 1975. 5 fig, 1 tab, 26 ref.

Descriptors: Lead, *Precipitation(Atmospheric), *Aerosols, *Lead radioisotopes, *Radioactivity techniques, Air pollution, Heavy metals, Pollutants, Public health, Rain, Rainfall, Snowfall, Fallout, Analytical techniques, Tracers, Radioisotopes, Snow, Path of pollutants.
Identifiers: *Lead-210, *Japan, Hokkaido(Japan), Sea of Japan, Continenetal aerosols, Transport of aerosols, Dry fallout, Mineral constituents, Radon-222, Radioactive nuclides, Radon.

Total precipitation including rain or snow and dry fallout was collected once a month from February 1970 to March 1972 at 5 sampling stations in Hakkaido located from the coast of the Sea of Japan to inland. The monthly deposition rate of Pb-210 was determined together with other chemical constituents. The results are summarized as follows: (1) the deposition rate and the concentration of Pb-210 are remarkably high in winter; (2) a linear relation between the deposition rate of Pb-210 and the amount of rainfall is found in both summer and winter respectively; (3) as compared with the production rate of Pb-210, namely the exhalation rate of Rn-222 from the continent, the deposition rate of Pb-210 to the unit area at the coast of the Sea of Japan in winter is 2-4 times the exhalation rate of Rn-222 from the continent, and (4) the budget calculation of Pb-210 in the atmosphere shows that about 40% of aerosols transported from the continent are caught by snow and deposited over the Sea of Japan and the Japan Islands in winter. Therefore, it was concluded that the Japan Islands play an important role as a collector of the continental aerosols in winter. (Henley-ISWS)
W76-03385

MONITORING AGRICULTURAL POLLUTION USING NATURAL FLUORESCENCE,
Saskatchewan Research Council, Saskatoon.
For primary bibliographic entry see Field 5A.
W76-03387

NEW TRITIUM DATA ON MOVEMENT OF GROUNDWATER IN WESTERN FRESNO COUNTY, CALIFORNIA,
Geological Survey, Sacramento, Calif.
J. F. Poland, and G. L. Stewart.
Water Resources Research, Vol 11, No 5, p 716-724, October 1975. 8 fig, 2 tab, 10 ref.

Descriptors: *Water pollution sources, *Tritium, *Groundwater, *Path of pollutants, *California, Data collections, Sampling, Water wells, Nuclear explosions, Radioactivity effects, Evaluation.
Identifiers: *Fresno County(Calif), Thermonuclear tritium.

As a result of thermonuclear explosions that began in 1954, tritium concentrations in precipitation and streamflow in the northern hemisphere have fluctuated greatly. Well waters along two traverse lines in western Fresno County, Calif., were sampled in 1963 and tested for tritium concentration. Haskell et al, (1966) estimated from the apparent thermonuclear tritium concentrations that groundwater had moved westward in the lower water-bearing zone at a maximum velocity of 14-16.5 miles (23-27 km) in 9 years. The maximum velocities and permeabilities estimated from the 1963 sampling were about an order of magnitude greater than the velocities and permeabilities suggested by prior hydrologic and geologic evidence. Consequently, in 1966-1970 the U.S. Geological Survey sampled and tested the tritium concentrations of well waters along the same two traverses but also extended the sampling eastward. On the basis of these analyses it is concluded that (1) thermonuclear tritium had not invaded the lower zone by 1970 within the extent of the 1963 sampling and (2) although the maximum westward movement of groundwater in the lower zone from 1955 to 1970 is indeterminate, it has been less than 4 miles (6.5 km) from the recharge area in 15 years. (Woodard-USGS)
W76-03388

CHEMICAL QUALITY OF GROUND WATER IN THE NORTHERN PART OF THE ALBUQUERQUE-BELEN BASIN, BERNALILLO AND SANDOVAL COUNTIES, NEW MEXICO,
Geological Survey, Albuquerque, N. Mex.
W. L. Hiss, F. W. Trainer, B. A. Black, and D. R. Posson.
In: New Mexico Geological Society Guidebook, 26th Field Conference, Las Cruces County, p 219-235, 1975. 3 fig, 4 tab, 28 ref.

Descriptors: *Water quality, *Chemical analysis, *Groundwater, Aquifer characteristics, Hydrogeology, *New Mexico, Geochemistry, Groundwater movement, Water types, Chemical properties, Chemical reactions, Data collections.
Identifiers: Bernalillo County(N Mex), Sandoval County(N Mex), Albuquerque-Belen basin(N Mex).

Aquifers within Cenozoic strata in the Rio Grande rift constitute some of the most important groundwater reservoirs in New Mexico. The Albuquerque-Belen basin, the largest of the south-trending series of grabens that forms the Rio Grande rift, is about 30 miles wide and 90 miles long. Albuquerque, with a population of about 285,000, pumps an average of 68.5 million gallons of water per day from wells tapping Cenozoic aquifers. This stress on the aquifer system is increased by pumping for the estimated additional 100,000 people living in nearby communities and suburban developments--perhaps as much as 23.5 million gallons of water per day. Water brought into the basin by underflow is of a calcium sodium bicarbonate composition and some of it also contains appreciable sulfate. Hydraulic interrelations between the Rio Grande and the aquifers along its course control infiltration from the river. The infiltrated water is of relatively good chemical quality, although the quality of Rio Grande water below the Jemez River reflects the dissolved load brought in from the Jemez uplift. (Woodard-USGS)
W76-03394

WATER QUALITY,
Geological Survey, Menlo Park, Calif.
J. D. Hem, and T. D. Steele.
Reviews of Geophysics and Space Physics, Vol 13, No 3, p 461-468, July 1975. 211 ref.

Descriptors: *Water quality, *Reviews, *United States, Data collections, Networks, Analytical techniques, Model studies, Data processing, Chemical properties, Water quality control, Evaluation, Documentation, *Bibliographies.

Significant contributions in the broad area of water quality over the quadrennium 1971-1974 are highlighted. The diversity of subject areas within this topic heading and the large volume of published research results necessitated the selection of representative indicator contributions. The references cited are believed to be indicative of general trends in research and of the more important developments during this period. Many additional citations could have been made. In the United States, recent federal legislation, specifically the Federal Water Pollution Control Act Amendments of 1972 (Public Law 92-500) and related research and monitoring activities, the bulk of which have been coordinated, through the Environmental Protection Agency and the Department of the Interior's Office of Water Resources Research, have served to simulate many of the recent technological advances in several aspects of water quality. A brief discussion of the products of some of these efforts is included. Efforts have concentrated on developing or improving laboratory analytical methods, field-sampling procedures (including telemetering of instrument-monitoring data and remote sensing), and interpretation of data records (specific interest has been indicated in time trend analysis). This summary is concerned primarily with chemical aspects of water quality. (Woodard-USGS)
W76-03395

WATER QUALITY, FOUNTAIN AND JIMMY CAMP VALLEYS, COLORADO, 1973,
Geological Survey, Denver, Colo.
J. M. Klein, and D. L. Bingham.
Colorado Water Conservation Board, Denver, Water Resources Circular No 26, 1975. 27 p, 11 fig, 1 plate, 5 tab, 22 ref.

Descriptors: *Water quality, *Surface waters, *Groundwater, *Irrigation water, *Colorado, Data collections, Sampling, Chemical analysis, Streams, Water wells, Chemical properties, Evaluation, Dissolved oxygen.
Identifiers: Fountain and Jimmy Camp Valley(Colo).

A series of dissolved oxygen profiles of Fountain Creek indicates that, due to natural processes, the dissolved oxygen in the stream recovers from the pollution load imposed in the vicinity of Colorado Springs, Colo. Monthly monitoring data indicate that seasonal fluctuations in temperature and stream discharge determine the distribution of biochemical oxygen demand downstream from points of pollution loading. Oxygen removal coefficients were determined for various points in the stream. The main inorganic constituents in water from Fountain Creek at Pueblo are calcium, sodium, and sulfate. Hardness ranges from 170 to 920 milligrams per litre, and the dissolved-solids concentration ranges from 374 to 2,020 milligrams per litre. Groundwater in the area under-goes a general increase in dissolved-solids concentration in a downstream direction. The groundwater is classified in the medium to very high salinity hazard and low to medium sodium hazard groups in relation to suitability for irrigation. (Woodard-USGS)
W76-03404

HYDROLOGIC DATA FOR URBAN STUDIES IN THE SAN ANTONIO, TEXAS METROPOLITAN AREA, 1973,
Geological Survey, Austin, Tex.
For primary bibliographic entry see Field 7C.
W76-03406

COMPLEXATION SIDE REACTIONS INVOLVING TRACE METALS IN NATURAL WATER SYSTEMS,
California Univ., Davis. Div. of Environmental Studies.
For primary bibliographic entry see Field 2K.
W76-03411

FE-MN OXIDE COATINGS IN STREAM SEDIMENT GEOCHEMICAL SURVEYS,
Georgia Univ., Athens. Dept. of Geology.
R. H. Carpenter, T. A. Pope, and R. L. Smith.
Journal of Geochemical Exploration, Vol 4, No 3, p 349-363, September, 1975. 7 fig, 3 tab, 21 ref.

Descriptors: *Heavy metals, *Iron, *Manganese, *Geochemistry, *Sediments, Tennessee, Georgia, Zinc, Lead, Trace elements, *Path of pollutants, Pollutant identification.
Identifiers: Geochemical exploration.

The present study is an initial attempt to evaluate whether or not the concentrations of certain metals in the Fe-Mn oxide coatings on lithic, quartz and minus 80 fractions of th coexisting stream sediment can be spacially related to known mineral deposits in a drainage basin. Downstream dispersion curves for cert ain trace metals were obtained from two mineralized areas in Tennessee and Georgia. Coatings are shown to effectively reflect Zn and Cu mineralization in drainage basins but are insensitive to Pb mineralization as Pb does not concentrate in the coatings. The anomaly/background ratio in the coatings is higher than in the minus 80 fraction. Advantages of using coatings versus the conventional minus 80-mesh fraction in stream geochemical surveys are discussed. (Hoyle-Vanderbilt)
W76-03412

PROBLEMS OF INDIVIDUAL SUPPLIES,
Environmental Protection Agency, Washington, D.C. Office of Water Supply.
For primary bibliographic entry see Field 5F.
W76-03434

LEGAL CONTROLS FOR PROTECTING UNDERGROUND SOURCES OF DRINKING WATER,
Virginia Polytechnic Inst. and State Univ., Blacksburg. Water Resources Research Center.
For primary bibliographic entry see Field 5F.
W76-03435

CONTAMINANTS IN RAINWATER AND THEIR RELATION TO WATER QUALITY, PART II,
Suffolk County Dept. of Environmental Control, N. Y.
For primary bibliographic entry see Field 5A.
W76-03445

SIMULATION OF BOD AND DO BALANCE WITH RESPECT TO POLLUTED SHALLOW-RIVER (PART 2): SIMULATION EXAMPLE FOR MIDDLE COURSE TAMAGAWA (ASAI ODAKU KASEN NI OKERU BOD, DO SHUSHI NO SIMURASHON (DAI 2 HO): TAMAGAWA CHURYUIKI E NO TEKIYO REI),
S. Aiba, M. Okada, H. Otake, R. Sudo, and T. Mori.
Gesuido Kyokai-shi, (Journal of the Japan Sewage Works Association), Vol 12, No 132, p 26-37, May, 1975. 18 refs.

Descriptors: *Rivers, *Biochemical oxygen demand, *Dissolved oxygen, Water quality, Colorimetry, Model studies, *Simulation analysis, Chemical oxygen demand, Mannings equation, Spectrophotometry, Pollutant identification.
Identifiers: Japan.

Data obtained at eleven locations between Hanemura dike and Chofu dike, Japan, (total length 93 km) in August 1972 were used for a simulation model of BOD and dissolved oxygen balance in a polluted shallow river. Water temperature was recorded by the Japanese standard method using a glass thermometer; clarity was measured by a one m meter. Illumination was recorded by a 2501-A model illuminometer while pH value was measured by a colorimetric method. Dissolved oxygen, COD, total phosphorus, and BOD were also determined by appropriate standard Japanese methods. Nitrogen was determined by a spectrophotometric method. Dissolved oxygen and COD at Hinobashi ranged from 4.4 mg/liter at 10:30 p.m. to 19.9 mg/liter at 8:30 a.m., and from 2.2 mg/liter at 10:30 p.m. to 4.0 mg/liter at 1:30 p.m., on August 15, respectively. The overall photosynthesis and respiration rates for algae were measured and various parameters were estimated for the simulation. A greater second stage BOD load was obtained, due to inaccurate river bed area calculated by Mannings equation. Results of the simulation also showed lower BOD and restoration of dissolved oxygen at night. (Su-FIRL)
W76-03446

SOME INITIAL EFFECTS ON WATER QUANTITY AND QUALITY OF AN EXPERIMENTAL ROADING AND TIMBER HARVESTING OPERATION IN A VICTORIAN MOUNTAIN CATCHMENT,
Melbourne and Metropolitan Board of Works (Australia).
For primary bibliographic entry see Field 4C.
W76-03447

THE INFLUENCE OF LAND USE ON STREAM SALINITY IN THE MANJIMUP AREA, WESTERN AUSTRALIA.
For primary bibliographic entry see Field 4C.
W76-03452

EVALUATION OF HEAT DISTRIBUTION IN A SOUTH CAROLINA RESERVOIR RECEIVING HEATED WATER,
Savannah River Ecology Lab., Aiken, S.C.
For primary bibliographic entry see Field 5C.
W76-03463

ENERGY COST-BENEFIT MODELS FOR EVALUATING THERMAL PLUMES,
Florida Univ., Gainesville. Dept. of Environmental Engineering Sciences.
For primary bibliographic entry see Field 5C.
W76-03496

5C. Effects Of Pollution

WATER QUALITY IN IOWA STREAMS: SUMMARY OF A CONFERENCE HELD MARCH 1975.
Iowa State Univ., Ames. Dept. of Animal Ecology.
For primary bibliographic entry see Field 5A.
W76-03004

BLOOD OXYGEN CAPACITIES OF EELS ACCLIMATED TO FRESH-, BRACKISH-, AND SALT-WATER ENVIRONMENTS,
Bridgeport Univ., Conn. Dept. of Biology.
D. L. Guernsey, and J. J. Poluhowich.
Comparative Biochemistry and Physiology, Vol 52A, p 313-316, 1975. 2 fig, 1 tab, 22 ref.

Descriptors: *Eels, *Fish physiology, *Salinity, Oxygen, Analytical techniques, Water quality, Saline water, Brackish water, Freshwater, Water pollution effects.
Identifiers: *American eel, *Anguilla rostrata, *Blood oxygen capacities, Tissue analysis, Hematocrit.

Groups of American eels, Anguilla rostrata, were acclimated to three environmental salinities and their blood oxygen capacities determined. The brackish-water group exhibited the highest mean oxygen capacity and weight-specific oxygen capacity. Highly significant differences were demonstrated between the oxygen capacities of the freshwater and marine groups and between the brackish water and marine groups. A significant difference was not observed between the freshwater and brackish-water eels. Weight-specific blood oxygen capacities for the three groups exhibited an inverse relationship with body weight. The American eel, under different salinity regimes, showed a relationship between oxygen capacity and hematocrit, which appeared to be altered by ambient salinity. The lower oxygen capacities and hematocrits observed in the salt water-acclimated eels suggested that the yellow eel is programmed for a freshwater and/or brackish water existence and that acclimation to higher salinities disrupted its normal blood oxygen relationhsips. (Klein)
W76-03015

IN VIVO OXYGEN TOXICITY IN INVERTEBRATES AND VERTEBRATES,
Michigan State Univ., East Lansing. Dept. of Physiology.
R. J. Hoffert, D. A. Baeyens, and P. O. Fromm.
Comparative Biochemistry and Physiology, Vol 52A, p 351-353, 1975. 2 tab, 9 ref.

Descriptors: *Shrimp, *Fish, *Minnows, *Crabs, *Animal physiology, *Toxicity, *Oxygen, Invertebrates, Water pollution effects.
Identifiers: False pilchard, Harengula clupeola, Fathead minnow, Pimephales prommelas, Crayfish, Orconectes propinquus, Fiddler crab, Uca pugnax, Mouse, Mus musculus, Peneus setiferus.

Representatives of six diverse species (shrimp, Peneus setriferus; False pilchard, Harengula clupeola; Fathead minnow, Pimephales prommelas;

Crayfish, Orconectes propinquus; Fiddler crab, Uca pugnax; and mouse, Mus musculus) were exposed in vivo to 5 atm absolute of 100% oxygen. The toxic action of oxygen was measured by quantitating decreases in oxygen consumption. Terrestrial and marine organisms showed marked decreases in oxygen consumption within 3 hours of exposure. Species from fresh water habitats were more resistant to O2 toxicity. A possible explanation was suggested. (Klein)
W76-03016

SPECTRAL ANALYSIS OF OLFACTORY RESPONSES TO AMINO ACIDS IN RAINBOW TROUT, SALMO GAIRDNERI,
Tokyo Univ. (Japan). Zoological Inst.; and Tokyo Univ. (Japan). Faculty of Sciences.
M. Satou, and K. Ueda.
Comparative Biochemistry and Physiology, Vol 52A, p 359-365, 1975. 5 fig, 23 ref.

Descriptors: *Smell, *Organoleptic properties, *Rainbow trout, *Amino acids, Fish physiology, Biochemistry, Salmonids, *Spectroscopy, Pollutant identification, Water pollution effects.
Identifiers: Olfactory centers, Olfactory nerve.

Solutions of different amino acids elicited electrical olfactory responses with different spectral patterns when recorded from olfactory nerve or brain of rainbow trout, Salmo gairdneri. The responses of the olfactory centers had entirely different frequency structures from those of the olfactory nerve. An ability for olfactory discrimination between amino acids was suggested from the frequency spectral patterning of the responses in rainbow trout. (Klein)
W76-03017

IMPACT OF KRAFT PULP-MILL EFFLUENTS ON ESTUARINE AND COASTAL FISHES IN APALACHEE BAY, FLORIDA, USA,
Florida State Univ., Tallahassee. Dept. of Biological Science.
R. J. Livingston.
Marine Biology, Vol 32, p 19-48, 1975. 14 fig, 7 tab, 98 ref.

Descriptors: *Pulp wastes, *Effluents, Speciation, Population, Species, Dissolved oxygen, Habitats, Productivity, Environmental effects, Water quality, Sampling, *Florida, *Estuarine environment, Estuaries, Water pollution effects.
Identifiers: Bay anchovy, Anchoa mitchilli, Apalachee Bay(Fla).

Offshore areas in north Florida that received kraft pulp-mill effluents (KME) displayed significant increases in color and turbidity and reductions in dissolved O2 compared with a nearby control area. Estuarine and marsh fish assemblages in areas of acute impact were severely reduced in numbers of individuals and species. Species diversity could not be used as an indicator of pollution per se, and was useful only when considered in conjunction with various other parameters. Transition areas (between polluted and unpolluted areas) showed increases in species diversity, individuals, and species. In general, the effects of KME on offshore fish assemblages appeared to be due to a complex combination of habitat alteration, reduced benthic productivity, and behavior reactions. Overall, there were some significant changes in the biota such as reduced dominance and productivity in polluted areas that were similar for the various types of organisms sampled. (Klein)
W76-03018

HEART RATE OF THE CRAB SCYLLA SERRATA (FORSKAL) IN AIR AND IN HYPOXIC CONDITIONS,
Rhodes Univ., Grahamstown (South Africa). Dept. of Zoology and Entomology.
B. J. Hill, and H. Koopowitz.
Comparative Biochemistry and Physiology, Vol 52A, p 385-387, 1975. 3 fig, 9 ref.

Descriptors: *Crabs, *Animal physiology, *Oxygen demand, Water quality, Respiration, Water pollution effects, Air pollution effects.
Identifiers: *Scylla serrata, Heart rate, *Hypoxia, Aerial exposure.

The heart-rate of the crab Scylla serrata in normoxic water but isolated from stimuli was initially 70-80 beats per minute but declined to 25-35 beat/minute after 72 hours. Exposure to air caused rapid brady-cardia. 50% of the initial heartrate was reached after 7-18 hours. The heart-rate increased in crabs exposed to hypoxic conditions but declined in oxygen tensions below 50 mm Hg. (Klein)
W76-03019

EFFECTS OF ARTIFICIALLY ELEVATED WATER TEMPERATURES ON THE GROWTH, REPRODUCTION AND LIFE CYCLE OF A NATURAL POPULATION OF PHYSA VIRGATA GOULD,
Texas Univ. at Arlington. Dept. of Biology.
R. F. McMahon.
Ecology, Vol 56, No 5, p 1167-1175, 1975. 3 fig, 55 ref.

Descriptors: *Thermal pollution, Texas, *Snails, *Mollusks, *Growth rates, *Life cycles, Life history studies, Effluents, Reproduction, Sampling, Heated water, Environmental effects, Waste water(Pollution), Water pollution effects.
Identifiers: *Physa virgata, Thermal effluent.

Samples were collected from two natural populations in Texas of Physa virgata, one affected by heated discharge from a power plant. Investigations of growth, reproduction, life cycle and the effects of effluent showed that each population had three generations per year. More northern physid populations have a simple annual pattern or at most two generations per year. Even without artificially elevated water temperatures the longer growing seasons which occurred in the southwestern USA allowed P. virgata populations to achieve three generations per year. The autecology of these two snail populations was remarkably similar; observed differences included a more rapid rate of growth of the second generation and a decrease in mean number of eggs laid in the discharge area. (Klein)
W76-03020

CADMIUM IN PLANKTON: ELEVATED CONCENTRATIONS OFF BAJA CALIFORNIA,
Moss Landing Marine Labs., Calif.
For primary bibliographic entry see Field 5B.
W76-03021

IMPACT OF SEWAGE ON THE DISTRIBUTION, ABUNDANCE AND COMMUNITY STRUCTURE OF ROCKY INTERTIDAL MACROORGANISMS,
California Univ., Irvine. Dept. of Population and Environmental Biology.
M. M. Littler, and S. N. Murray.
Marine Biology, Vol 30, No 4, p 277-291, 1975. 7 fig, 2 tab, 41 ref. OWRT A-054-CAL(1)

Descriptors: *Sewage, Wastes, *Domestic wastes, *Succession, *Intertidal areas, Habitats, *Biological communities, *Community development, Cyanophyta, Environmental effects, Life cycles, Speciation, Primary productivity, Water pollution effects, *Path of pollutants.
Identifiers: Sewage-Tolerant Organisms, Suspension feeders, Omnivores, Egregia laevigata, Halidrys dioica, Sargassum agardhianum, Phyllospadix torrey, Pterocladia capillacea, Serpulorbis squamigerus, Ulva californicus, Gelidium pusillum and Corallina officinalis.

The biological effects of a low volume domestic discharge were studied from February to June 1972. There were fewer species and less cover near the outfall than in nearby 'unpolluted' control areas. The outfall biota was less diverse; a great reduction in community stratification and complexity occurred near the outfall due to the absence of Egregia laevigata, Halidrys dioica, Sargassum agardhianum, and Phyllospadix torreyi. These were replaced by Ulva californica, Gelidium pusillum, Pterocladia capillacea, Serpulorbis squamigerus and Corallina officinalis. The critical effect of the outfall was suggested to be the decrease in environmental stability favoring rapid-colonizers and more sewage-tolerant organisms. The outfall macrophytes, were characterized by relatively higher net primary productivities, smaller growth forms, simpler and shorter life histories, and most were components of simpler and early successional stages. (Klein)
W76-03023

DIVERSITY AND OVERLAP AS MEASURES OF ENVIRONMENTAL QUALITY,
Woods Hole Oceanographic Institution, Mass.
For primary bibliographic entry see Field 6G.
W76-03024

CADMIUM IN NEW ZEALAND DREDGE OYSTERS: GEOGRAPHIC DISTRIBUTION,
Marine Dept., Wellington (New Zealand). Fisheries Research Div.
For primary bibliographic entry see Field 5B.
W76-03025

GAS-BUBBLE DISEASE: MORTALITIES OF COHO SALMON, ONCORHYNCHUS KISUTCH IN WATER WITH CONSTANT TOTAL GAS PRESSURE AND DIFFERENT OXYGEN-NITROGEN RATIONS,
National Marine Fisheries Service, Seattle, Wash. Northwest Fisheries Center.
R. R. Rucker.
Fishery Bulletin, Vol 73, No 4, p 915-918 1975. 3 fig, 3 tab, 3 ref.

Descriptors: *Salmonids, *Salmon, *Gases, *Nitrogen, *Oxygen, Pressure, Fish diseases, Bubbles, Mortality, Tolerance, Toxicity, Water pollution effects.
Identifiers: *Gas-Bubble disease, *Oncorhynchus kisutch, Fingerlings, *Coho Salmon.

Coho salmon (Oncorhynchus kisutch) fingerlings were subjected to a total gas pressure of 119% at 13.6C with the 02/N2 varying from 50%/138% to 229%/90%. The small fish (3.8-6cm) were the most resistant to gas bubble disease at the gas concentrations used. A drastic decrease in lethal effect of individual rations of O2 and N2 occured between 159% O2/ 109% N2 and 173% O2/105% N2 at the same total gas pressure (119). (Klein)
W76-03026

MERCURY AND IRON UPTAKE BY CYTOSOMES IN MANTLE EPITHELIAL CELLS OF QUAHOG CLAMS (MERCENARIA MERCENARIA) EXPOSED TO MERCURY,
National Inst. of Environmental Health Sciences, Research Triangle Park, N.C. Environmental Toxicology Branch.
B. A. Fowler, D. A. Wolfe, and W. F. Hettler.
Journal of the Fisheries Research Board of Canada, Vol 30, No. 10, p 1767-1775, 1975. 7 fig, 1 tab, 19 ref.

Descriptors: *Animal physiology, *Mercury, *Clams, *Iron, Path of Pollutants, Absorption, Metabolism, Bivalves, Toxicity, Bioassay, Analytical techniques, Metals, Pollutant identification, Water pollution effects.
Identifiers: *Quahog clams, *Mercenaria mercenaria, Bioaccumulation, Histology, Tissue analysis.

Specimens of the quahog clam, Mercenaria mercenaria, were placed in sea water containing mercury (Hg++) concentrations of 0.1, 1, and 10 parts per million (ppm) for 6 days. A dose-related increase of electron dense cytosomes was observed by electron microscopy in mantle tentacle epithelial cells of mercury-treated clams. Energy dispersive X-ray microanalysis of these cytosomes disclosed the presence of high iron concentrations in reltion to mercury. Analysis of mantle fringes from the same clams by atomic absorption spectroscopy showed marked changes in tissue iron levels of mercury-treated clams in comparison to controls. (Klein)
W76-03027

FOULING COMMUNITY CHANGES INDUCED BY THE THERMAL DISCHARGE OF A HAWAIIAN POWER PLANT,
Hawaiian Electric Co., Inc., Honolulu. Environmental Dept.
J. C. McCain.
Environmental Pollution, Vol 9, p 63-83, 1975. 3 fig, 7 tab, 22 ref.

Descriptors: *Heated water, *Thermal pollution, Temperature, Electric power industry, Wildlife, Biomass, Population, Biological communities, Speciation, Water pollution sources, *Hawaii, Water pollution effects, *Powerplants.

An examination of the epifauna collected on fifty fouling panels was made to determine the influence of the thermal discharge from the Waiau Steam-Electric Generating Station on these organisms. Many of the organisms were found to differ significantly in abundance, biomass, and percent cover between the thermally affected and non-affected areas. Three species clusters or communities were identified on the panels tidal non-thermally affected communities. The latter were roughly separated by the 3C isotherm of temperature above ambient which corresponded to a summer maximum of approximately 32C. (Klein)
W76-03028

THE EFFECT OF TEMPERATURE AND SALINITY ON THE HEART BEAT OF CRASSOSTREA VERGINICA,
Connecticut Univ., Noank. Marine Research Lab.
S. Y. Feng, and W. Van Winkle.
Comparative Biochemistry and Physiology, Vol 50, No. 3A, p 473-476, 1975. 3 fig, 1 tab, 6 ref.

Descriptors: *Temperature, *Salinity, *Oysters, Animal physiology, Water quality, Water pollution effects.
Identifiers: *Heart beat, Acclimation.

Crassostrea virginica from New Jersey and Connecticut were acclimated to low salinities in the laboratories. Heart beat was measured at various temperature-salinity combinations to evaluate the ability of oysters to acclimate to the low salinity levels. Time of acclimation to low salinities did not significantly affect recovery of heart beat for either stock. Heart beat of New Jersey oysters above 10C was less inhibited following a gradual decrease in salinity than following an abrupt decrease in salinity. Rate of acclimation to lower salinities appears to be less than 5 ppt per day. Heart beat of Connecticut oysters showed a maximum at intermediate salinities at 520 and 30 C, but heart beat was relatively insensitive to salinity at 5 and 10C. Similar, although less conclusive, results were obtained with New Jersey oysters. (Klein)
W76-03029

INTERACTION OF ODOUR AND FLOW PERCEPTION AND THE EFFECTS OF PARATHION IN THE LOCOMOTOR ORIENTATION OF THE GOLDFISH CARASSIUS AURATUS L.,
Texas A and M Univ., College Station. Dept. of Biology.
G. H. Rand, H. Kleerekoper, and J. Matis.
Journal of Fish Biology, Vol 7, No 4, p 497-504, 1975. 4 fig, 4 tab, 21 ref.

Descriptors: *Odor, *Fish behavior, *Organoleptic properties, *Water circulation, *Organophosphorus compounds, Water quality, Water pollution effects.
Identifiers: *Carassius auratus, *Locomotor orientation, *Parathion, *Goldfish.

The effects were studied of a 24 hour exposure to a subacute concentration of parathion on the locomotor orientation of mature goldfish, Carassius auratus, 26-30 cm long, in response to a food odor and a water flow differential, singly and in combination, in a free choice situation. Results suggested that short term exposure to the organophosphate affected not only the perception of food odor and flow individually, but also the interaction between these common environmental stimuli. (Klein)
W76-03030

THE INFLUENCE OF ACTIVITY LEVEL ON BRADYCARDIA IN TROUT (SALMO GAIRDNERI) DURING HYPOXIA,
Boston Univ., Mass. Dept. of Biology.
M. J. Weintraub.
Journal of Fish Biology, Vol 7, p 791-796, 1975. 2 fig, 19 ref.

Descriptors: *Salmonids, *Rainbow trout, *Analytical techniques, Radio communication systems, Fish physiology, Fish diseases, Oxygen, Methodology, Electricity, Water pollution effects.
Identifiers: *Hypoxia, Bradycardia, Heart rate.

Voltages associated with heartbeat were transmitted by radio from free-swimming rainbow trout (Salmo gairdneri). Variability in the bradycardia response associated with the hypoxic state was observed and appeared to be related to the normal activity state of the fish. Bradycardia as a physiological mechanism was discussed on the basis of this finding. (Klein)
W76-03031

EFFECTS OF VARIOUS CONCENTRATIONS OF DISSOLVED ATMOSPHERIC GAS ON JUVENILE CHINOOK SALMON AND STEELHEAD TROUT,
National Marine Fisheries Service, Seattle, Wash. Northwest Fisheries Center.
E. M. Dawley, and W. J. Ebel.
Fishery Bulletin, Vol 73, No 4, p 777-796, 1975. 4 fig, 2 tab, 18 ref.

Descriptors: *Salmonids, *Chinook salmon, *Salmon, *Trout, *Gases, Juvenile growth stage, Pressure, Dissolved oxygen, Nitrogen, Argon, Fish physiology, Fish physiology, Fish behavior, *Rainbow trout, Mortality, Toxicity, Water pollution effects.
Identifiers: *Oncorhynchus tshawtscha, Salmo gairdneri, Coho salmon, Bioaccumulation, Tissue analysis, Blood chemistry.

Bioassays in shallow tanks with dissolved nitrogen and argon gas concentrations ranging from 100 to 125% of saturation in water at 15C were conducted to determine lethal and sublethal effects on juvenile chnook salmon (Oncorhynchus tshawytscha) and steelhead trout (Salmo gairdneri). Significant mortality of both species commenced at 115% saturation of nitrogen and argon. Over 50% mortality of both steelhead and chinook occurred in less than 1.5 days in water at 120 and 125% of saturation. Significant differences in swimming performance, growth and blood chemistry were measured in groups of fish tested at sublethal exposures in various concentrations of dissolved gases. Sublethal stress for 35 day at 110% dissolved nitrogen decreased normal swimming ability of chnook. Growth of both steelhead and chnook was affected by sublethal exposures in water saturated with atmospheric nitrogen and argon at 105, 110 and 115%. Blood chemistry was affected at sublethal exposures in water at 115% saturation. (Klein)
W76-03032

RENAL EXCRETION IN COHO SALMON (ONCORHYNCHUS KISUTCH) AFTER ACUTE EXPOSURE TO 3-TRIFLUOROMETHYL-4-NITRO-PHENOL,
Bureau of Sport Fisheries and Wildlife, La Crosse, Wis. Fish Control Lab.
J. B. Hunn, and J. L. Allen.
Journal of the Fisheries Research Board of Canada, Vol 32, No. 10, p 1873-1876, 1975. 1 fig, 2 tab, 15 ref.

Descriptors: *Salmonids, *Salmon, *Organic compounds, *Fish physiology, Sodium, Potassium, Calcium, Magnesium, Chlorine, Bioassay, Toxicity, Water pollution effects.
Identifiers: *Oncorhynchus kisutch, *3-Trifluoromehtly-4-Nitrophenol, *TFM, Urine, Bioaccumulation, Excretion, *Coho salmon.

Coho salmon (Oncorhynchus kisutch) exposed to an acute, sublethal concentration of 3-trifluoromethly 1-4 nitrophenol (TFM) exhibited an increased output of urine when compared with controls, but the urinary excretion of Na, K, Ca, Mg and C1 was not affected. About 35 times more conjugated TFM than free TFM was excreted during the 24-hour study period. (Klein)
W76-03033

BLOOD AND LIVER ENZYMES IN RAINBOW TROUT (SALMO GAIRDNERI RICH) WITH EMPHASIS ON THEIR DIAGNOSTIC USE: STUDY OF CC14 TOXICITY AND A CASE OF AEROMONAS INFECTION,
Montreal Univ., (Quebec). Dept. of Biology.
J. G. Racicott, M. Gaudet, and C. Leray.
Journal of Fish Biology, Vol 7, p 825-835, 1975. 4 fig, 1 plate, 4 tab, 18 ref.

Descriptors: *Rainbow trout, *Salmonids, *Organic compounds, *Enzymes, Biochemistry, Fish diseases, Fish physiology, Analytical techniques, Toxicity, Water pollution effects.
Identifiers: *Carbon-Tetra-Chloride, *Aeromonas infection, Tissue analysis, Enzymatic activity.

The effect of one intraperitoneal injection of 1.33 ml of CC14 per kg of fish was studied. The activity of all enzymes in the blood (LDH, GOT, GPT, GR, GDH, CPK, G-6-Pase, and Alk Pase) increased. The enzymes reached maximal activity 12 hours after injection of diluted CC14. The levels of some enzymes in the liver were also examined. Histopathological observations were correlated with the enzymatic studies. An Aeromonas disease characterized by the destruction of the dermis, the exposure of the muscle, and by the presence of numerous petechiae in the liver allowed examination of the relationships between naturally induced tissue damage and enzyme levels in blood. The levels of seven blood enzymes were determined and the most significant modifications were observed for LDH and CPK which increased their concentration from 3 to 7 times respectively. A pyruvate saturation test demonstrated that LDH was probably from liver as it was observed after CC14 poisoning. The contribution of such biochemical studies in fish research was evaluated. (Klein)
W76-03034

EFFECTS OF TEMPERATURE ON FOOD INGESTION RATE AND ABSORPTION, RETENTION, AND EQUILIBRIUM BURDEN OF PHOSPHORUS IN A AQUATIC SNAIL, GONIOBASIS CLAVEAFORMIS LEA,
Oak Ridge National Lab., Tenn. Environmental Sciences Div.
J. W. Elwood, and R. A. Goldstein.
Freshwater Biology, Vol 5, No 5, p 397-406, 1975. 5 fig, 1 tab, 22 ref..

Descriptors: *Temperature, *Absorption, *Snails, *Phosphorus, *Phosphorus radioisotopes, Equilibrium, Water quality, Feeding rates, Retention, *Digestion, *Thermal pollution, Water pollution effects.
Identifiers: *Goniobasis clavaeformis, *Equilibrium burden, Bioaccumulation.

The effects of sublethal temperatures on feeding rates and phoshorus dynamics of the freshwater snail, Goniobasis clavaeformis, were determined and feeding rates were measured at four temperatures. Food ingestion rate incrfeased with increasing temperature up to 14C and decreased at temperatures above 14C. The elimination rate of absorbed phosphorus increased with increasing temperature. Mean retention times of absorbed phosphorus were estimated to be 34, 24, 20 and 6 days at 10, 13.8, 15, and 19.3C, respectively. The absorption efficiency of phosphorus was estimated to be constant at about 39% for all experimental temperatures. The equilibrium body burden of phosphorus in Goniobasis increased with increasing temperatures up to a maximum at 11-12C and then decreased above 12C. (Klein)
W76-03036

(THE EFFECT OF OXIDIZED MATERIAL ON THE VERTICAL DISTRIBUTION OF FRESHWATER BENTHIC FAUNA,
State Univ., Coll., Brockport, N.Y. Dept. of Biological Sciences.
W. B. Kirchner.
Freshwater Biology, Vol 5, No 5, p 423-429, 1975. 1 fig, 4 tab, 10 ref.

Descriptors: *Vertical distribution, *Oxidized material, Ostracoda, Harpacticoida, Cyclopida, Chironomidae.

The vertical distribution of representatives of the benthic groups: Ostracoda, Nematoda, Oligochaeta, Harpacticoida, Cyclopoida, and Chironomidae was determined. All groups had their highest numbers and biomass in the first 2 cm. The downward extent of oxidized material affected the distribution by dispersing the biomass more as seen by the deeper occurrence of groups when the oxidized material increased. Both the nematodes and oligochaetes were found to inhabit the first reduced layer when the oxidized material was less than normal. (Klein)
W76-03037

THE DEVELOPMENT OF CARP GONADS IN WARM WATER AQUARIA,
Bundesforschungsanstalt fuer Fischerei, Hamburg (West Germany). Institut fuer Kuesten-und Binnenfischerei.
Journal of Fish biology, Vol 7, p 775-782, 1975. 2 fig, 1 tab,2 plates.

Descriptors: *Gonads, Histology.

The development of carp (Cyprinus carpio) gonads in warm water (23C) aquaria was described. Males matured at 6 months of age; females ripened at 14 months, and by 15 months 25% of these began spawning. Under natural conditions female European carp do not ripen until they are 4 years old. Sexual maturation of the ovaries, based on histological changes, was described in six stages and associated with changes in the female gonadosomatic index and the maximum ova diameter. Maturation of the tests occurred in four stages. Larger fishes became sexually mature before smaller fishes. (Klein)
W76-03038

SALINITY TOLERANCE OF LABORATORY-REARED LARVAE OF THE CALIFORNIA KILLIFISH, FUNDULUS PARVIPINNIS GIRARD,
California Univ., Irvine. Dept. of Population and Environmental Biology.
T. R. Rao.
Journal of Fish Biology, Vol 7, p 783-790, 1975. 3 fig, 2 tab, 18 ref.

Descriptors: *Killifishes, *Larvae, *Fish physiology, *Salinity, *Salt tolerance, Embryonic growth stage, Water pollution effects.
Identifiers: *Fundulus parvipinnis, Freshwater tolerance.

Newly hatched larvae of the California killifish (Fundulus parvipinnis) reared in the laboratory, were tolerant of salinities from fresh water to 70%. Their salinity tolerance was influenced by incubation salinity; larvae hatched in lower incubation salinities exhibited greater freshwater tolerance than those hatched in higher salinities. In gradual acclimation tests, the upper median lethal salinity for the larvae was 130%. Freshwater tolerance of the larvae decreased with age; yolk sac larvae were completely tolerant of fresh water while larvae more than 15 days old were least resistant. (Klein)
W76-03039

SALINITY TOLERANCE OF THE TIDEPOOL SHRIMP PALAEMON RITTERI HOLMES,
Pennsylvania State Univ., Wilkes-Barre.
W. W. Reynolds.
Comparative Boichemistry and Physiology, Vol 52, No 4A, p 665-667, December 1975. 2 fig, 2 tab, 11 ref.

Descriptors: *Water quality, *Salinity, *Salt tolerance, *Shrimp, Lehtal limit, Toxicity, Growth stages, Crustaceans, Water pollution effects, Desalination plants.
Identifiers: *Palaemon ritteri, *Tidepool shrimp.

The upper and lower incipient lethal salinity for non-moulting Palaemon ritteri were 47.5% and 10% at 20C respectively. Rescently moulted tidepool shrimp were unable to tolerate salinities of 15, 20, or 40%. Present salinities in some coastal environments of the Northern Gulf of California were approximate to the upper lethal salinity for moulting P. ritteri. Brine effluents from a proposed nuclear desalting plant could cause local salinity conditions in excess of the upper incipient lethal salinity for P. ritteri. (Klein)
W76-03040

EFFECTS OF BRIEF TEMPERATURE INCREASES ON LARVAE OF MULINIA LATERALIS (MOLLUSCA:BIVALVIA),
Virginia Inst. of Marine Science, Gloucester Point.
R. J. Diaz.
Journal of the Fisheries Research Board of Canada, Vol 32, No 10, p 1870-1872, 1975. 2 tab, 6 ref.

Descriptors: *Temperature, *Toxicity, *Larval growth, Stage, Heated water, Mortality, Mollusks, Water pollution effects, *Thermal pollution.
Identifiers: *Mulinia lateralis.

Temperature increases of 10, 15 and 20C for 30 minutes significantly increased 48-h mortality of Mulinia lateralis. Growth of surviving larvae was temporarily decreased only by a 20-degree temperature increase. No interaction was found between age of larvae when exposed and mortality after brief temperature increases. (Klein)
W76-03041

STUDIES ON THE SWIMMING MUSCULATURE OF THE RAINBOW TROUT, II. MUSCLE METABOLISM DURING SEVERE HYPOXIA,
Bristol Univ., (England). Research Unit for Comparative Animal Respiration.
I. A. Johnston.
Journal of Fish Biology, Vol 7, No 4, p 459-468, 1975. 3 tab, 48 ref.

Descriptors: *Rainbow trout, *Salmonids, *Fish physiology, *Fish diseases, Movement, Biochemistry, Water quality.
Identifiers: *Muscle movement, *Hypoxia, Tissue analysis, Anaerobic pathways.

Some aspects of anaerobic metabolism in the red and white (mosaic) muscles of the rainbow trout (Salmo gairdneri) have been studied during environmental hypoxia. Evidence has been obtained for the operation of anaerobic pathways other than glycolysis, especially in the superficial red muscle. L-alanine and succinate were observed to accumulate as anaerobic endproducts in this tissue. Anaerobic glycolysis also increased significantly during hypoxia, but only in the white muscle. Glycogen stores were depleted by 70-85% in both red and white muscle. Glucose increased in concentration in the red but not in the white muscle. In an attempt to understand some of the species differences in the susceptibility of fish to hypoxia the results of the present study have been compared with an earlier study on the carp. The effect of death from hypoxia on the levels of muscle metabolites has also been studied. (Klein)
W76-03042

LONG-TERM EFFECTS OF 4-AMINOPYRIDINE EXPOSURE TO BIRDS AND FISH,
Bureau of Sport Fisheries and Wildlife, Denver, Colo. Denver Wildlife Research Center.
E. W. Schafer, Jr., and L. L. Marking.
Journal of Wildlife Management, Vol 39, No 4, p 807-811, 1975. 3 tab, 9 ref.

Descriptors: *Organic compounds, *Toxicity, *Birds, *Fish, Water quality, Channel catfish, Water temperature, Environmental effects, Bioassay, Water pollution effects.
Identifiers: *Avian frightening agent, *4-aminopyridine, *Bioaccumulation, LC-50, Nontarget wildlife, Bobwhites, Colinus virginianus, Starlings, Sturnus vulgaris, Coturnix quail, Coturnix coturnix, Mourning doves, Zenaida macroura, Ictalurus punctatus, Bluegill, Lepomis macrochirus.

The avian frightening agent, 4-aminopyridine (4AP), was tested on five avian and two fish species to assess the effects of long-term 4AP exposure to nontarget vertebrates. LC-50's were determined for mourning doves (Zenaida macroura), bobwhites (Colinus virginianus), starlings (Sturnus vulgaris), and coturnix quail (Coturnix coturnix). Mortality in all avian species appeared to be the result of acute poisoning, and no evidence of cumulative toxicity was noted. In 96-hour static tests, channel catfish (Ictalurus punctatus) and bluegill (Lepomis macrochirus) showed increasing sensitivity to 4AP with time in test waters ranging from very soft to very hard and from 12-22C. The 96-hour LC-50's for both species ranged from 2.43 to 7.56 mg/liter (ppm). Toxicity appeared to decrease with increasing water temperatures but was generally unaffected by water hardness. On the basis of the data presented and the currently registered rate for 4AP in agricultural crops, long-term hazards to nontarget wildlife were judged to be minimal. (Klein)
W76-03043

ACUTE EFFECTS OF METHYL MERCURY TOXICITY IN CHANNEL CATFISH (ICTALURUS PUNCTATUS) KIDNEY,
Mississippi Univ., Jackson. Dept. of Anatomy.
M. W. Kendall.
Bulletin of Environmental Contamination and Toxicology, Vol 13, No 5, p 570-578, May 1975. 4 fig, 1 plate, 1 tab, 29 ref. OWRT A-038-KY(6). 14-31-0001-3817.

Descriptors: Freshwater fish, *Catfishes, *Channel catfish, *Fish physiology, *Metals, *Mercury, Analytical techniques, Bioassay, Laboratory tests, Path of pollutants, Water pollution effects, Metabolism, *Toxicity.
Identifiers: Kidneys, *Methyl mercury, *Sublethal concentrations, Bioaccumulation, Tissue analysis.

A single intraperitoneal injection of 15 mg/kg methyl mercuric chloride caused deposition of mercury in the kidney of channel catfish (Ictalurus punctatus), inhibition of histochemically localized succinic dehydrogenase activity, and marked pathology as evidenced by necrosis of renal tubular cells and increased thickening of renal glomerular basement membrane. (Klein)
W76-03044

ENVIRONMENTAL SALINITY: ITS FAILURE TO INFLUENCE GROWTH OF ATLANTIC SALMON (SALMO SALAR) PARR,
Fisheries and Marine Service, St. Andrews (New Brunswick). Biological Station.
H. M. Shaw, R. L. Saunders, and H. C. Hall.
Journal of the Fisheries Research Board of Canada, Vol 30, No 10, p 1821-1824, 1975. 2 fig, 1 tab, 18 ref.

Descriptors: *Salinity, *Salt tolerance, *Growth rates, *Atlantic salmon, Salmonids, Metabolism, Fish physiology, Environmental effects, Water pollution effects.
Identifiers: Bioaccumulation.

Growth of Atlantic salmon (Salmo salar) parr was studied at environmental salinities of 0.1, 10 and 20% in relation to daily rations of 0, 1.0, 1.5, 2.2, and 2.9% of dry body weight. Instantaneous growth rates and food conversion efficiencies for fish in each salinity were similar. Maintenance ration was slightly more in 20% than in either the salinity approximately isosmotic with blood (10%) or in fresh water (0.1%). (Klein)
W76-03045

TEMPERATURE INCREASE CAN CAUSE HYPERECDYSONISM IN AMERICAN LOBSTERS (HOMARUS AMERICANUS) INJECTED WITH ECDYSTERONE,
Fisheries and Marine Service, St. Andrews (New Brunswick). Biological Station.
D. E. Aiken, and S. L. Waddy.
Journal of the Fisheries Research Board of Canada, Vol 30, No 10, p 1843-1845, 1975. 1 fig, 7 ref.

Descriptors: *Lobsters, *Crustaceans, *Temperature, Toxicity, Growth rates, Thermal pollution, Water pollution effects.
Identifiers: *American lobster, *Molting, *Hormones, *Ecdysterone, Bioaccumulation.

In the lobster Homarus americanus the threshold dose for premolt acceleration by ecdysterone could be altered by changes in temperature. Two dose levels of ecdysterone were compared at three temperatures. All doses remained subthreshold at 10C, but at 17C the 1.0 microgram dose caused hyperecdysonism-rapid but abnormal completion of premolt terminating in death at ecdysis. In contrast, the 0.5 microgram dose remained subthreshold even at 21C. Results demonstrated a dose-temperature relation for response to injected ecdysterone. (Klein)
W76-03046

SOME METHODOLOGY FOR APPRAISING CONTAMINANTS IN AQUATIC SYSTEMS,
Battelle-Northwest, Richland, Wash. Pacific Northwest Lab.
For primary bibliographic entry see Field 5B.
W76-03048

ACUTE TOXICITY OF BENZENE, A COMPONENT OF CRUDE OIL, TO JUVENILE STRIPED BASS (MORONE SAXATILIS),
National Marine Fisheries Service, Tiburon, Calif. Tiburon Fisheries Lab.
R. D. Meyerhoff.
Journal of the Fisheries Research Board of Canada, Vol 30, No 10, p 1864-1866, 1975. 1 fig, 11 ref.

Descriptors: *Organic compounds, *Aromatic compounds, *Oil, *Striped bass, Salinity, *Toxicity, Juvenile growth stage, Fish physiology, Water pollution effects.
Identifiers: *Benzene, Morone saxatilis, Bioaccumulation.

The acute toxicity of benzene, a major constituent in crude oil of volatile aromatic compounds, to 1.5 plus or minus 0.5 gram juvenile striped bass (Morone saxatilis) was studied in a continuous flow laboratory bioassay system. At 17.4C and 29ppt salinity, the lethal threshold concentration and the 96-h LC50 for benzene were 10.9 microliters/liter. The 95% confidence interval was 10.9 plus or minus 0.2 microliters/liter and the probit line slope, 'S', was 1.1. Possible toxic mechanisms were discussed. (Klein)
W76-03049

INDUCED POLYPOIDY IN TILAPIA AUREA (STEINDACHNER) BY MEANS OF TEMPERATURE SHOCK TREATMENT,
New York Ocean Science Lab., Montauk. Dept. of Ichthyology.
R. J. Valenti.
Journal of Fish Biology, Vol 7, No 4, p 519-528, 1975. 1 fig, 3 tab, 41 ref.

Descriptors: *Genetics, *Chromosomes, *Reproduction, Cytology, Gonads, Growth stages, Fish physiology, Methodology, Analytical techniques, Temperature, Thermal pollution, Water pollution effects, *Tilapia.
Identifiers: Tilapia aurea, *Blue tilapia, *Polyploidy, *Temperature shock treatment, Gametes.

A technique for increasing ploidy in the blue tilapia, Tilapia aurea was investigated for the purpose of determining its effect on standard length. Gametes of T. aurea were stripped from ripe adults and eggs were fertilized with donor sperm from several males. A description of the extra-oral incubation system used for the embryos is provided. This system resulted in a maximum of 90% successful hatch. Normal egg development was interrupted by immersion of newly fertilized eggs (15 min post-insemination) in cold or hot water for various durations. The reliability of these techniques for inducing polyploidy was examined using increased volume of erythrocyte nuclei as a criteria for success. A cold shock of from 32C (ambient) to 11C for a 1 hour duration resulted in the largest incidence of polyploidy (75%). Polyploid fish were found to be larger than diploid siblings when measured at 14 weeks of age. (Klein)
W76-03050

PROBLEMS ASSOCIATED WITH LOW-SOLUBILITY COMPOUNDS IN AQUATIC TOXICITY TESTS: THEORETICAL MODEL AND SOLUBILITY CHARACTERISTICS OF AROCLOR 1254 IN WATER,
Environmental Protection Agency, Gulf Breeze, Fla. Gulf Breeze Environmental Research Lab.
For primary bibliographic entry see Field 5A.
W76-03052

STUDIES OF TOLERANCE TO HEAVY METALS IN THE FLORA OF THE RIVERS YSTWYTH AND CLARACH, WALES,
University Coll. of Wales, Aberystwyth. Dept. of Botany and Microbiology.
R. O. McClean, and A. K. Jones.
Freshwater Biology, Vol 5, No 5, p 431-444, 1975. 6 fig, 8 tab, 31 ref.

Descriptors: *Metals, *Chlorophyta, Resistance, Iron, Lead, Copper, Zinc, Manganese, Growth rates, Water pollution sources, Mining, Diatoms, Water pollution effects.
Identifiers: Fontinalis squamosa, Scapania undulata, Hormidium rivulare, Wales, Ystwyth River, Clarach River.

The Ystwyth river was found to be heavily polluted with metals, especially below the areas of old lead mines. Hormidium rivulare was the most tolerant filamentous green algae present. Scapania undulata was a tolerant bryophyte found almost exclusively in polluted sites. In general, lower levels of Fe, Pb and Mn were found in Scapania as compared with the less tolerant Fontinalis squamosa. Zn65 tracing experiments demonstrated that both plants had similar uptake patterns for the metal. There was no change in the number of diatoms found upon Scapania when it was transplanted, but a reduction in numbers occurred on the transplanted Fontinalis when it started dying. Diatom flora compositions differed in the polluted and unpolluted sites. (Klein)
W76-03053

EFFECT OF SOUTH LOUISIANA CRUDE OIL AND NO. 2 FUEL OIL ON GROWTH OF HETEROTROPHIC MICROORGANISMS, INCLUDING PROTEOLYTIC, LIPOLYTIC, CHITINOLYTIC AND CELLULOLYTIC BACTERIA,
Maryland Univ., College Park. Dept. of Microbiology.
J. D. Walker, P. A. Seeman, and R. R. Colwell.
Environmental Pollution, Vol 9, p 13-33, 1975. 16 fig, 6 tab, 45 ref.

Descriptors: *Bacteria, *Yeasts, *Oil wastes, *Microorganisms, *Fungi, Water pollution sources, Growth rates, Toxicity, Bays, Estuaries, Chesapeake Bay, Water pollution effects.
Identifiers: *Crude oil, *Fuel oil no 2, Bioaccumulation.

Muddy Creek, a sub-estuary of the Rhode River in Chesapeake Bay, was examined to determine the susceptibility of the autochthonous microorganisms to South Louisiana crude oil and No. 2 fuel oil. Muddy Creek sediment was found to be free of contaminating oil, whereas the crude oil was found to support growth of bacteria and the fuel oil to limit such bacterial growth. Normalizing the values with reference to the control cultures revealed that both the crude and fuel oils were toxic for the bacteria. The crude oil showed greater toxicity. (Klein)
W76-03054

A STUDY OF THE INTERTIDAL MACROFAUNA AROUND THE BP REFINERY (KENT) LIMITED,
City of London Polytechnic (England). Dept. of Biological Sciences; and Sir John Cass Coll., London (England). School of Science and Technology.
For primary bibliographic entry see Field 5B.
W76-03055

CONTRIBUTION TO THE STUDY OF THE EFFECT OF COPPER ON MYTILUS EDULIS DURING REPRODUCTIVE PERIOD,
Brussels Univ. (Belgium). Unite d'Histophysiologie.
W. Delhaye, and D. Cornet.
Comparative Biochemistry and Physiology, Vol 50, No 3A, p 511-518, 1975. 11 fig, 2 tab, 31 ref.

Descriptors: *Metals, *Mussels, *Toxicity, *Copper, Animal physiology, Reproduction, Spawning, Absorption, Respiration, Mortality, Water pollution effects.
Identifiers: *Bioaccumulation, *Mytilus edulis, Tissue analysis.

Aspects of copper toxicity in the mussel, Mytilus edulis, were studied. An acceleration in mortality occurred during the reproductive period. Respiration was similarly affected. Copper accumulation was high and rapid in the gills, and was also found to be at high levels in the mantle edge and foot. No accumulation organ was found, and after 48 hr the metal concentration decreased in all organs. A critical concentration seemed to exist with no

greater effects at higher concentrations. The spawning period corresponded with an acceleration of Cu uptake and consequently the critical concentration was more rapidly reached. (Klein)
W76-03056

CHROMATOPHORES OF THE TELEOST TILAPIA MELANOPLEURA -II. THE EFFECTS OF CHEMICAL MEDIATORS, MICROTUBULE DISRUPTING DRUGS AND OUABAIN,
Sao Paulo Univ. (Brazil). Departmento de Fisologia Geral; and Sao Paulo Univ. (Brazil). Inst. of Bio-sciences.
A. M. De L. Castrucci.
Comparative Biochemistry and Physiology, Vol 50, No 3A, p 457-462, 1975. 7 fig, 26 ref.

Descriptors: *Animal physiology, *Inhibitors, Enzymes, Biochemistry, Analytical techniques, Toxicity, Water pollution effects, *Teleosts.
Identifiers: *Tilapia melanopleura, *Tissue analysis, Pigments, Melanophores, Erythrophores, *Ouabain, *Adrenaline, Vinblastine, Sulphate, Colchicine, *Noradrenaline, Acetylcholine, Carbamylcholine.

Adrenaline and noradrenaline induced a fast aggregation of pigment granules in the melanophores and erythrophores of Tilapia melanopleura. Acetylcholine and carbamylcholine were ineffective in inducing pigment migration. Colchicine and vinblastine sulphate caused inhibition of both pigment aggregation and dispersion in melanophores and erythrophores by disruption of the microtubule pattern. Ouabain was a potent inhibitor of the migratory activity in melanophores and erythrophores, suggesting a Na-K- sensitive ATPase related to pigment movements. (Klein)
W76-03057

EFFECTS OF LARGE THERMAL DISCHARGES ON ICE-COVERED RIVERS,
Iowa Univ., Iowa City. Inst. of Hydraulic Research.
P. P. Paily, J. F. Kennedy, E. O. Macagno, and G. Dagan.
Available from the National Technical Information Service, Springfield, Va 22161 as PB-248 712, $3.50 in paper copy, $2.25 in microfiche. Completion Report, Iowa State Water Resources Research Institute No 68, September 1975. 10 p, 8 ref. OWRT B-034-IA(1), B-041-IA(1). 14-31-0001-3886/3956.

Descriptors: *Ice, *Rivers, *Thermal pollution, Melting, Temperaure, Heat transfer, Mathematical models, Winter, Hydraulics, Hydrodynamics.
Identifiers: *Thermal response, Meteorological conditions, Equilibrium ice-cover thickness, Waste heat.

The effects of large thermal discharges on ice-covered rivers were investigated analytically, numerically, and experimentally. Field investigations were also performed to compare the theoretical results. The study was conducted in two phases. During the first phase, the thermal response of rivers to hot water discharges under cold period conditions was investigated. A numerical solution for the general case and a closed-form solution for a particular case were developed to determine the water temperatures and lengths of ice-free reaches for various combinations of climatic and thermal discharge conditions. During the second phase of the study the effects of thermal discharges on melting rates of ice covers were investigated theoretically and experimentally. Simplified relations were developed to determine the cover thickness at any time after the initiation of melting. Theoretical solutions were also developed to determine the thickness profile of the cover and the distance translated by the ice cover. The analytical models were supported by results derived from experimental studies.
W76-03139

A PROXIMATE BIOLOGICAL SURVEY OF SAND DIEGO BAY, CALIFORNIA,
Naval Undersea Center, San Diego, Calif.
T. J. Peeling.
Available from NTIS, Springfield, Va 22161 as AD-A007 469, $5.00 in paper copy, $2.25 in microfiche. Naval Undersea Center Report No. NUC TP 389, Revision 1, January 1975. 85 p, 14 fig, 12 tab, 67 ref, 6 append.

Descriptors: *Surveys, Sampling, Environment, Aquatic environment, *Water quality, *Biological communities, Industrial wastes, Domestic wastes, Effluents, *California, Data collections.
Identifiers: *San Diego Bay(CA).

The results of a survey of San Diego Bay conducted from December 1972 to June 1973 are presented, including data on the historical uses of the bay, changes in water quality, and past and present biological conditions. On the basis of these data the following conclusions may be drawn: After a period of decline, water quality in San Diego Bay is improving; Domestic and industrial discharges into the bay have been virtually eliminated, except for raw sewage originating aboard military and civilian vessels and limited amounts of cooling and thawing waters; State and local water quality requirements are stringent and well enforced, and it is estimated that most waste discharges into the bay, including all those from military sources, will be eliminated by 1980; and a number of marine organisms, including commercially and recreationally important species, are abundant in the bay. (Sinha-OEIS)
W76-03170

LONG-TERM VARIABILITY IN THE STRUCTURE OF SUBTIDAL BENTHIC COMMUNITIES IN PUGET SOUND, WASHINGTON, USA,
Nordic Council for Marine Biology, Biomsterdalen (Norway). Espegrend Biological Station.
U. Lie, and R. A. Evans.
Available from NTIS, Springfield, Va 22161 as COM-75-10379, $3.50 in paper copy, $2.25 in microfiche. Reprint from Marine Biology, Vol 21, No 2, p 122-126, 1973, Washington Sea Grant Program, WSG-TA 73-8.

Descriptors: *Benthos, Aqutic life, *Variability, *Biological communities, Ecosystems, Bodies of water, Estuaries, Sounds, *Washington.
Identifiers: Species composition, *Puget Sound(WA).

Data on benthic infauna from 4 permanent stations in Puget Sound off Seattle, USA, collected during 1963-1964, 1967, and 1969, revealed considerable stability in numbers of species and specimens and in diversity within stations among sampling dates. The species composition of the faunal assemblages also remained rather constant during the period of investigation, but the relative dominance among the numerically important species varied somewhat. Biomass data did not differ significantly in 1964 and 1969, but the 1967 data were considerably lower at all stations. (Sinha-OEIS)
W76-03173

PESTICIDE DEGRADATION BY MARINE ALGAE,
Wisconsin Univ., Madison. Dept. of Entomology.
G. M. Boush, and F. Matsumura.
Available from NTIS, Springfield, Va 22161 as AD-D008 275, $3.50 in paper copy, $2.25 in microfiche. Office of Naval Research, Naval Biology Program, Final Report, Task No. NR 306-061, April 1975. 22 p, 13 tab, 3 ref.

Descriptors: *Pesticide residues, *Algae, *Cyanophyta, *Chlorinated hydrocarbon pesticides, *Water pollution, Growth rates, Food chains, Dieldrin, Endrine, 2-4-5-T. DDT, DDD, Aquatic populations, Microbial degradation, Pesticide toxicity.
Identifiers: Anacystis nidulans, Anacystis quadruplicatum, Phenylmercuric acetate.

Various algae species were tested for their susceptibilities towards chlorinated hydrocarbon insecticides. Dieldrin, the most frequently found pesticidal contaminant in the U.S., and its analogs were found to inhibit the growth of certain algae species. Anacystis nidulans in particular showed marked susceptibility to endrin, dieldrin, ketoendrin and photodieldrin. This species was also susceptible towards dieldrin metabolites such as metabolite F and G. Among DDT metabolites DDD (TDE) was found to be the most toxic followed by DDE, DDT and FW-152. Phenylmercuric acetate was by far the most toxic among all pesticidal chemicals tested to both A. nidulans and A. quadruplicatum at the concentration of 1 ppb. Algae, along with other plankton, are known to bioaccumulate pesticides and thereby play a vital role in the process of food-chain accumulation of these micropollutants. Studies indicate that the rates of pick-up of pesticides are very rapid. To study the feasibility of constructing a model ecosystem algae was used as a key food chain organism. TCDD, the most toxic contaminant of 2,4,5-T does not really accumulate in the aquatic organisms as compared to DDT. Algae as a whole are not very active in degrading pesticidal chemicals in vivo. They were found to play a key role in the process of environmental alteration of pesticidal residues. The way they participate in such processes was found to be through synergistic actions on photochemical reactions. (Sinha-OEIS)
W76-03174

EFFECTS OF OCEAN DISPOSAL ACTIVITIES ON MID-CONTINENTAL SHELF ENVIRONMENT OFF DELAWARE AND MARYLAND,
Environmental Protection Agency, Annapolis, Md. Annapolis Field Office.
D. W. Lear, and G. G. Pesch.
Available from NTIS, Springfield, Va 22161 as PB-239 256, $7.50 in paper copy, $2.25 in microfiche. U.S. Environmental Protection Agency, Philadelphia, PA, Report No. EPA 903/9-75-015, January 1975. 185 p, 44 fig, 22 tab, 2 append.

Descriptors: *Waste disposal, *Continental shelf, *Industrial wastes, *Sludge disposal, *Metals, *Water pollution, Paths of pollutants, Ocean circulation, Absorption, Environmental effects, Distribution patterns, *Delaware, *Maryland, Data collections.
Identifiers: *Ocean waste disposal, Waste accumulation.

Observations made over a period of approximately one year on two mid-temperate mid-continental shelf ocean dumpsites showed the hydrographic regime was generally approximate the classic winter isothermal-summer stratified system, but incursions of fresher water from the Delaware estuary and intrusion of offshore slope water were found to influence this hydrographic regime. Summer and winter density discontinuities may influence the distribution of conservative pollutants. The distribution of metals in bottom sediments and organisms indicate these potentially toxic materials persist in bottom materials, and are apparently translocated as a result of hydrographic forces. This increases their potential toxicity to a relatively great area, with its indigenous biota. There is evidence of accumulation in benthis organisms. The benthic substrate, medium to fine sands, does not apparently influence the distribution of the metals examined in this nondepositional environment. The microtopographic ridges and swales, observed directly from the submersible, may influence the local distribution of pollutants as well as biota. Observations of the benthic infauna are as yet incomplete, and may influence current conclusions when analyzed. Dumping operations of the acid waste source and of the sewage sludge materials are apparently separately distributed in the environment. An area of at least 1000 square nautical miles was affected. (Sinha-OEIS)
W76-03175

PHYSICAL, CHEMICAL, AND BIOLOGICAL CHARACTERISTICS OF NEARSHORE ZONE OF SAND KEY, FLORIDA, PRIOR TO BEACH RESTORATION. VOLUME I,
National Marine Fisheries Service, Panama City, Fla. Gulf Coastal Fisheries Center.
For primary bibliographic entry see Field 2L.
W76-03177

DETERGENT PHOSPHATE BAN YIELDS LITTLE PHOSPHORUS REDUCTION, PART I,
Purdue Univ., Lafayette, Ind. Dept. of Environmental Engineering.
For primary bibliographic entry see Field 5A.
W76-03235

PREDICTIVE MODEL FOR PHOSPHORUS IN LAKES,
North Carolina Univ., Chapel Hill. Dept. of Environmental Sciences and Engineering.
For primary bibliographic entry see Field 5B.
W76-03243

PRODUCTION OF MACROPHYTES OF SOME LAKES IN THE PSKOV REGION, (IN RUSSIAN),
Akademiya Nauk SSSR, Leningrad. Botanicheskii Institut.
A. P. Belavskaya, and N. B. Serafimovich.
Rastit Resur. Vol 9, No 3, p 355-369, 1973. Illus.
Identifiers: Charophyta, Dissection, Elodea-Canadensis, *Lakes, *Macrophytes, *Production, Russian-SFSR, Shoreline, *USSR(Pskov region), Alkalitrophic lakes.

Lakes of an alkalitrophic type of development, to which the investigated lakes (Alol, Beloe, Ostrovito, and Krivoe) of the Pskov region (Russian SFSR, USSR) belonged, are characterized by a considerable diversity of the flora of macrophytes. The degree of overgrowth of the lakes depended not so much on their area as on the degree of dissection of the shore line, number of islands, and character of the drop of the bottom in the littoral zone. With the exception of Lake Krivoe, submerged vegetation, especially communities of Charophyta and Elodea canadensis, predominated in the vegetation cover of the lakes. In view of the high productivity of Charophyta and the large areas occupied by it, lakes with a predominance of submerged vegetation gave the maximum annual production of air-dried matter (125.3 g/m2 for Lake Alol and 117.0 g/m2 for Lake Ostrovito). The production of organic matter depended to a considerable extent both on the productivity of the dominant plants and overgrowth areas and on the chemical composition of the macrophytes. Charophyta, haveing a high content of mineral compounds, contributes to the lake considerably less organic matter than the corresponding mass of air-dried vegetation.--Copyright, 1974, Biological Abstracts, Inc.
W76-03245

EFFECT OF HALOGENS AND OZONE ON SCHISTOSOMA OVA,
Virginia Polytechnic Inst. and State Univ., Blacksburg. Dept. of Civil Engineering.
N. Mercado-Burgos, R. C. Hoehn, and R. B. Holliman.
Journal Water Pollution Control Federation, Vol 47, No 10, p 2411-2419, October, 1975. 4 fig, 2 tab, 16 ref.

Descriptors: *Ozone, *Waste water treatment, *Disinfection, *Public health, Chlorine, Bromine, Iodine, *Halogens, Toxicity, Effluents, Water pollution sources.
Identifiers: *Schistosoma mansoni.

Basic technical data were compiled on the effectiveness of common disinfectants applied at different dosages and contact times against the ova of Schistosoma mansoni. These data on chlorine, iodine, bromine, and ozone, were evaluated for design of disinfection units in future waste water treatment plants. Schistosomias is a human parasitic disease that has been linked to the discharge of waste water into waterways; however, few treatment plants in high incidence areas practice disinfection. In this investigation, S. mansoni ova suspended in secondary treated waste water effluents were exposed to the various disinfectants. Although the exact mechanism is not known, chlorine was more effective than either iodine or bromine in schistosome ova elimination. In tests for ozone disinfection, difficulties were encountered because the ozone generating method was extremely inefficient. Additionally, the ozone demand of waste water made disinfection of schistosome ova by ozone difficult. Only at tests with 40 mg/liter was a complete elimination of the schistosoma possible. However, ozone does not form any toxic addition products with constituents of waste water as halogens do, and free ozone residuals are short-lived, especially in water containing organics. (Kramer-FIRL)
W76-03252

STUDY OF FLUORINE IN THE UKRAINE AND THE ENDEMIC FLUOROSIS CONNECTED THEREWITH (IZUCHENIE FTORA NA UKRAINE I SVYAZANNOGO NIM ENDEMICHESKOGO FLYUROZA),
R. D. Gabovich, and G. A. Stepanenko.
Gigiena i Sanitariya, No 7, p 13-16, 1975. 1 fig, 3 tab.

Descriptors: *Water supply, *Fluorine, Soils, Public health, Water sources, Groundwater, Artesian wells, Foods.
Identifiers: Dental fluorosis, *Ukraine, USSR.

A dynamic study has been conducted for the past 25 years on the fluorine content in the soils, natural water (both ground and artesian), foodstuffs, and daily food rations of the populations in four geochemical zones of the Ukraine in connection with the shifts in the incidence of dental fluorosis. The data of this study is presented. The causes of the decreases of the incidence of dental fluorosis in the case of a comparatively stable fluorine content in the environment are discussed. (Orr-FIRL)
W76-03254

HYGIENIC ASSESSMENT OF THE FLOTATION REAGENT T-66 IN THE WATER BODIES AND ITS MAXIMUM PERMISSIBLE CONCENTRATION (GIGIENICHESKAYA OTSENKA FLOTOREAGENTA T-66 V VODE VODOEMOV I EGO PREDEL'NO DOPUSTIMAYA KONTSENTRATSIYA),
L. V. Kudrin, S. M. Pavlenko, S. C. Zamyslova, and A. N. Sergeev.
Gigiena i Sanitariya, No 7, p 43-46, 1975. 1 fig, 1 tab.

Descriptors: *Water pollution sources, *Water pollution, Toxicity, Bodies of water, Standards, Bioassay, Public health.
Identifiers: Flotation agent T-66, Threshold concentration, Maximum allowable concentration.

The flotation reagent T-66 is a possible source of pollution in bodies of water. A complex series of hygienic investigations was performed in order to determine the features of the effect produced by T-66 on the organoleptic properties of water, and the sanitary regimen of the water body. Its effects on warm-blood animals under conditions of acute and chronic sanitary-toxicological experiments were determined with the use of a wide range of modern methods. A special toxicological index of noxiousness was proposed for the hygienic standardization of the flotation reagent in water bodies. A concentration of the substance at a level of 0.2 mg/liter was found to be subthreshold in warm-blooded animals; the concentration of 2.0 mg/liter was found to be threshold. The maximum permissible concentration of the flotation reagent T-66 is 0.2 mg/liter. (Orr-FIRL)
W76-03255

THE NUMBER, GENERATION TIME AND PRODUCTION OF BACTERIA IN THE VOLGA AND ITS RESERVOIRS IN 1970, (IN RUSSIAN),
For primary bibliographic entry see Field 5B.
W76-03262

VARIATIONS IN THE HYDROCHEMICAL REGIME OF THE COASTAL WATERS IN WINTER INFLUENCED BY MACROPHYTES, (IN RUSSIAN),
Murmanskii Morskoi Biologicheskii Institut (USSR).
L. E. Pozdnyakova, G. P. Garkavaya, and A. N. Golovkin.
Okeanologiya, Vol 13, No 3, p 426-431, 1973. Illus. (English summay).
Identifiers: *Algae, *Coastal waters, *Hydrochemical regime, *Macrophytes, Nitrogen, Phosphorus, Seasonal, *USSR(Dalnezelevetskaya Guba Bay), Winter, Absorption, Bays, Nutrients.

The experiments with the mass species of littoral and sublittoral algae made by the bottle method in the Dalnezelenetskay Guba (Bay) (USSR) in March 1968 are discussed. The semi-diurnal exposure reveals a specific character of nutrient salt consumption and the isolation of oxygen, organic N and P depending on a taxonomic position of algae. The winter biomass of macrophytes in the Murman coastal waters of the Barents Sea consumes dozens of kg of P and hundreds of kg of mineral N from the sea water per day. Due to the isolation by algae, the sea water becomes enriched in dissolved organic matter and oxygen. The coastal thickets of macrophytes change the stock of nutrient salts during the 2nd half of winter (period of the least stability of water masses) resulting in great diurnal fluctuations of chemical ingredients in the coastal water.--Copyright 1974, Biological Abstracts, Inc.
W76-03305

GROWTH RESPONSE OF THE GREEN ALGAE CHLORELLA VULGARIS TO SELECTIVE CONCENTRATIONS OF ZINC,
Herbert H. Lehman Coll., Bronx, N.Y. Dept. of Biological Sciences.
J. W. Rachlin, and M. Farran.
Water Research, Vol 8, p 575-577, 1974. 1 fig, 4 tab, 11 ref.

Descriptors: *Heavy metals, *Zinc, *Chlorella, *Growth rates, *Algal toxins, *Aquatic algae, Water pollution effects.
Identifiers: *Cell systems.

Effects of a divalent metal toxicant, zinc, on the growth response and therefore productivity of the green algae chlorella vulgaris were evaluated. The cultures were grown in modified Bristol's medium at 15.5 deg.C. with a program of 16 h light and 8 h dark. The concentration of zinc which reduced the growth rate of the test population of this alga, during a 96 h exposure, by 50%, was 2.4 plus or minus 0.02 ppm. The statistical technique of probit analysis was used on the data to calculate this effective concentration. The test design concerns itself with productivity reduction rather than standard survival of the test organism, and allows for the design of parallel studies in which the same technique can be used to assess the effects of toxicants on both animal and plant cell systems. (Hoyle-Vanderbilt)
W76-03307

A FOOD CHAIN MODEL OF CADMIUM IN WESTERN LAKE ERIE,
Manhattan Coll., New York.
For primary bibliographic entry see Field 5B.
W76-03310

EFFECTS OF LEAD CHLORIDE ON CHLOROPLAST REACTIONS,
Illinois Univ. at Urbana-Champaign. Inst. for Environmental Studies.
M. B. Bazzaz.
Environmantal Letters, Vol 6, No 3, p 175-191, 1974. 3 fig, 2 tab, 37 ref.

Descriptors: *Heavy metals, Pollutants, *Environmental effects, *Photosynthesis, Vegetable crops, Chemical reactions, Toxicity, *Lead.
Identifiers: Lead ions, Lead chloride, *Chloroplast reactions, *Photosystem activity, Conformational changes, Thylakoid membranes, Lead treatment, Tris-washing, Chlorophyll fluorscence, Lead pigment systems, Biochemical reactions, Maize.

Experimental data suggest multiple and complex effects of lead ions on chloroplast reactions. Lead chloride causes inhibition or stimulation of photosystem II activity in maize chloroplasts depending on the pH of the reaction media. At pH 7.8, an inhibition of 16 to 39% with 0.75mM to 9mM PbC12 is observed; while at pH 6.5 a stimulatory effect of 20% is observed with 9mM PbC12. These effects cannot be explained by the uncoupling of photophosphorylation, or by the ability of PbC12 to donate electrons to photosystem II. A common site of inhibition between water and the primary electron donor, Z, of the photosystem II for lead treatment and Tris-washing (0.8M, pH 8.0) of chloroplasts is suggested. Lead salts (0.9mM) at both pH 6.5 and 7.8 induced about 20% inhibition of the variable chlorophyll a fluorescence, and an increase in the ratio of pigment system I to II fluorescence upon the addition of lead salts at both pHs - an opposite effect to that induced by salts of other divalent ions such as Mg2+. Lead salts (0.9mM to 9mM) cause 10 to 20% increase in the 540nm absorbance change, reflecting a decrease in spaces between thylakoids, over that of untreated chloroplasts. The results are explained in terms of lead-induced conformational changes in thylakoid membranes of chloroplasts, leading to changes in energy distribution between pigment systems I and II. (Gregory-Vanderbilt)
W76-03317

EFFECTS OF CADMIUM NITRATE ON SPECTRAL CHARACTERISTICS AND LIGHT REACTIONS OF CHLOROPLASTS,
Illinois Univ. at Urbana-Champaign. Inst. for Environmental Studies.
M. B. Bazzaz.
Environmental Letters, Vol 6, No 1, p 1-12, 1974. 4 fig, 22 ref.

Descriptors: *Heavy metals, *Pollutants, *Environmental effects, *Photosynthesis, *Vegetable crops, Toxicity, Chemical reactions, Cadmium, Corn(Field), *Chlorophyll.

Cadmium, a major toxic environmental contaminant, in the form of Cd2+, was shown to be a potent inhibitor of photosynthesis in mesophyll chloroplasts from maize. Photosystem (PS) II activities (2, 6 dichlorophenol indophenol photoreduction and the variable fluorescence yield of chlorophyll (Chl)a) are inhibited strongly by 0.5 mM cadmium, supplied as Cd(NO3)2. Diphenylcarbazide was found to restore these activities suggesting that cadmium inhibits PSII activity at the oxygen evolving site between water and Y (the first secondary electron donor of PSII). PSI activity (light induced P700 oxidation) was not sensitive to the concentrations of cadmium that inhibit water oxidation almost completely. Absorption and fluorescence studies showed that cadmium causes a 20% to 30% decrease in the total chlorophylls, 15% to 25% decrease in the ratio of Chla/Chb, and a 20% to 25% decrease in the ratio of the short to the long wavelength forms of Chla. (Gregory-Vanderbilt)
W76-03318

EFFECTS OF DETERGENT FORMULATION ON WASTEWATER CHARACTERISTICS AND TREATMENT,
Black, Crow and Eidsness, Inc., Gainesville, Fla.
For primary bibliographic entry see Field 5D.
W76-03329

STUDIES OF GULL LAKE, MICHIGAN: I. SEASONAL AND DEPTH DISTRIBUTION OF PHYTOPLANKTON,
University of East Anglia, Norwich (England). School of Environmental Sciences.
B. Moss.
Freshwater Biol, Vol 2, No 4, p 289-307, 1972, Illus.

Descriptors: *Phytoplankton, *Lakes, *Diatoms, *Michigan, Distribution patterns, Cyanophyta.
Identifiers: Asterionella formosa, Chroococcus, Cyclotella michiganiana, Fragilaria crotonensis, *Gull Lake(Mich), Synechococcus, Synedra acus.

The seasonal and depth distribution of phytoplankton in Gull Lake, a moderately large, temperate, dimictic, recreational lake in southern Michigan, is described and discussed. Diatoms (Fragilaria crotonensis, Cyclotella michiganiana, Asterionell formosa and Synedra acus) dominate the spring phytoplankton. Populations of cryptomonads, green flagellates, and non-bloom-forming blue-green algae (Chroococcus and Synechococcus) grow mainly in summer. Diatoms grew under the winter ice, and objections are lodged to the classic explanation of seasonal growth in temperate lakes, and to a recent hypothesis concerning the 'paradox of the plankton'. Two raphe-bearing large diatom species were considered to be truly planktonic. A Synechococcus sp. was similar to that described previously only from Loch Leven.--Copyright 1973, Biological Abstracts, Inc.
W76-03338

WATER AND THE SOUTH FLORIDA ENVIRONMENT,
Geological Survey, Miami, Fla.
H. Klein, J. T. Armbruster, B. F. McPherson, and H. J. Freiberger.
Available from the National Technical Information Service, Springfield, Va. 22161, as PB-236 951, $9.00 in paper copy, $2.25 in microfiche. Water-Resources Investigations 24-75, August 1975. 165 p, 33 ref.

Descriptors: *Environmental effects, *Water quality, *Surface waters, *Groundwater, *Florida, Evaluation, Water resources, Hydrologic data, Water pollution sources, Urbanization, Industrial wastes, Municipal wastes, Insecticides, Land use, Saline water intrustrusion, Recreation facilities, Waste disposal, Aquifers, Ecology, Watershed management, Planning.
Identifiers: Southern Florida.

The population and industrial growth and the urban sprawl in south Florida has caused concern to agencies involved in land-use planning and water management as to the adequacy of the freshwater supply, and of the changes in environmental factors that could affect both the quantity and the quality of the fresh-water supply. This report describes the surface-water and groundwater resources of south Florida, the hydrologic system, past and present, and the interrelation of fresh water with estuarine and marine waters. Also considered are the problems, present or future, related to the hydrologic environment that involve human, animal, and plant life. The report provides alternative solutions to current environmental problems, with emphasis on alternatives that might be used to minimize alteration of the environment of south Florida in years to come. (Woodard-USGS)
W76-03402

THE EFFECTS OF TEMPERATURE UPON THE TOXICITY OF CHEMICALS TO AQUATIC ORGANISMS,
Virginia Polytechnic Inst. and State Univ., Blacksburg. Dept. of Biology; and Virginia Polytechnic Inst. and State Univ., Blacksburg. Center for Environmental Studies.
J. Cairns, Jr., A. G. Heath, and B. C. Parker.
Hydrobiolgia, Vol 47, No 1, p 135-171, July, 1975. 2 fig, 1 tab, 126 ref.

Descriptors: Pollutants, *Heavy metals, *Temperature, *Toxicity, Aquatic life, Trace elements, Laboratory tests, Animal physiology, Bioassay, Toxins, Water pollution, Animal Pathology, Mortality, Environmental effects, Aquatic microorganisms, *Thermal pollution, Thermal stress, Poisons, Mercury, Ammonia, Pesticide toxicity, Herbicides, Fish, Water pollution effects.
Identifiers: *Lethal concentrations, Threshold concentration, *Cyanide toxicity.

A review is presented of the available data on the relationship between water temperature and the effects of toxic chemicals on aquatic organisms. A large number of articles appear on either temperature or chemical effects, but very few apply to the direct interaction between temperature and chemical toxicity. The data come from laboratory tests; field data in this area are almost non-existent. Both aquatic animals and microorganisms are included in the survey. Laboratory tests involving ammonia, cyanide, and trace metals including zinc, cadmium, copper, chromium, and mercury are described. Most studies reported were bioassays of fish which measured changes in the lethal level of toxic substances or in the time required for death at a given concentration as a function of water temperature. Pesticides, herbicides, phenols, and chlorine are also discussed. The pertinent data from each laboratory test are given and the probable physiological mechanism is described. (Davis-Vanderbilt)
W76-03413

THE EFFECTS OF DESALINATION BRINES ON CRASSOSTREA VIRGINICA (GMELIN),
Dow Chemical Co., Freeport, Tex. Texas Div.
E. F. Mandelli.
Water Research, Vol 9 p 287-295, 1975. 5 fig, 7 tab, 17 ref.

Descriptors: *Desalination, *Desalination wastes, *Brine disposal, *Oysters, *Toxins, Fungi, Reproduction, Copper, Bioassay.
Identifiers: Crassostrea virginica.

The effects of seawater diluted desalination brines on juvenile and adult specimens of C. virginica from the Gulf of Mexico have been assessed using long term seasonal bioassay tests (60 days). The relatively high copper content of the brine dilutions (19.3-43 micrograms total Cu per 1, 60% was a soluble fraction) produced toxic chronic effects on both juvenile and adult oysters. The effects included high mortality rates during the spring and summer season, enhanced development of the parasite fungus L. marina in the oysters, copper accumulation in the oysters' tissues depending on copper concentrations of the seawater-brine mixtures and natural physiological activity, and deterioration of reproductive activity. (Hoyle-Vanderbilt)
W76-03414

NEW ENVIRONMENTAL HEALTH PROBLEMS IN WATER SUPPLY,
National Inst. of Environmental Health Services, Research Triangle Park, N.C.
For primary bibliographic entry see Field 5F.
W76-03425

EPIDEMIOLOGY OF WATERBORNE DISEASE IN THE UNITED STATES 1971-1973,
Center for Disease Control, Atlanta, Ga. Bureau of Epidemiology.
For primary bibliographic entry see Field 5F.
W76-03426

ENTERIC VIRUSES AND DRINKING WATER SUPPLIES,
North Carolina Univ. at Chapel Hill. Dept. of Environmental Sciences and Engineering.
For primary bibliographic entry see Field 5F.
W76-03427

OVERVIEW OF PROBLEMS ASSOCIATED WITH INORGANIC CONTAMINANTS IN DRINKING WATER,
Environmental Protection Agency, Cincinnati, Ohio.
For primary bibliographic entry see Field 5F.
W76-03429

SOME INITIAL EFFECTS ON WATER QUANTITY AND QUALITY OF AN EXPERIMENTAL ROADING AND TIMBER HARVESTING OPERATION IN A VICTORIAN MOUNTAIN CATCHMENT,
Melbourne and Metropolitan Board of Works (Australia).
For primary bibliographic entry see Field 4C.
W76-03447

THE INFLUENCE OF LAND USE ON STREAM SALINITY IN THE MANJIMUP AREA, WESTERN AUSTRALIA.
For primary bibliographic entry see Field 4C.
W76-03452

EVALUATION OF HEAT DISTRIBUTION IN A SOUTH CAROLINA RESERVOIR RECEIVING HEATED WATER,
Savannah River Ecology Lab., Aiken, S.C.
W. M. Lewis, Jr.
In: Thermal Ecology, CONF-730505, Proceedings of a symposium held at Augusta, Georgia May 3-5, 1973. p 1-27, 11 fig, 4 tab, 12 ref, append. USAEC AT(38-1)-310.

Descriptors: *Thermal pollution, *Water pollution effects, *Heterogeneity, *Thermal stratification, *Distribution, Heat, Discharge(Water), Heated water, Epilimnion, Hypolimnion, *South Carolina, Reservoirs, Path of pollutants.

Temperature data from a thermally polluted lake was collected and studied in terms of the total heat per unit of surface area in excess of a specific base temperature, the mean temperature of the upper water column, and an index of thermal heterogeneity. An algorithm is provided for calculating these indexes from any verticle profile. Heat distribution in a reservoir is illustrated using the concepts of excess heat, mean epilimnetic temperature, and thermal heteogeneity. Heat is horizontally distributed near the discharge with waste heat being largely confined to a surface layer even at the discharge point. Studies of heat distribution showed that total heat above the base line can be much lower near the discharge than at other points in the lake due to internal seiches and possibly of variations in wind exposure but thermal heterogeneity was always highest near the discharge point. Effects of natural solar warming, winds, interruption of heat flow, and other factors were also studied. During the early spring, extraordinary hypolimnetic warming of the lake occurs. This is attributed to the addition of waste heat. (See also W76-02004) (Chilton-HNL)
W76-03463

TEMPERATURE EFFECTS ON THE SORPTION OF RADIONUCLIDES BY AQUATIC ORGANISMS.
Du Pont de Nemours (E. I.) and Co., Aiken, S.C.; and Savannah River Ecology Lab., Aiken, S.C.
In: Thermal Ecology, CONF-730505, Proceedings of a symposium held at Augusts, Georgia May 3-5, 1973. p 28-42, 6 fig, 6 tab, 18 ref. USAEC AT(07-2)-1.

Descriptors: *Thermal pollution, *Water pollution effects, *Radioisotopes, *Soration, *Water temperature, Aquatic animals, Aquatic algae, Cesium, Cobalt, Iron, Manganese, Strontium, Zinc, South Carolina.
Identifiers: Stigeoclonium lubricum, Navicula seminulum, Plectonema botyanum, Glyptotendipes paripes, Chironomus plumosus, Palaemonetes paludosus.

Green alge showed no significant changes in growth or sorption of Cs137, Sr85, Fe59, Co57 and Mn54 at water temperatures of 23 to 32 degrees C. At 32 degrees, C, growth of Navicula seminulum was inhibited and radionuclide concentrations were 2 to 5 times higher than at lower temperatures. At 40 degrees C, blue-green alga showed no significant change in the sorption of Cs137, Sr85, Zn65, and Fe59. Concentrations of Co57 in P. boryanum decreased with increased water temperature and concentrations of Mn54 increased from 25 to 35 degrees C. Midge larvae were relatively poor radionuclide concentrators. At temperatures of 20 to 31 degrees C, no significant change in radionuclide sorption was seen in larvae of Glyptotendipes paripes and Chironnus plumosus. A 12 degreec temperature differential had little effect on the sorption of Cs137, Sr85, and Zn65 by whole shrimp during the 21 day study. Sorption levels varied inversely with temperature but radionuclide concentrations in whole shrimp decreased by factors of less than 3 as water temperatures were raised from 20 to 32 degrees C. (See also W76-02004) (Chilton-HNL)
W76-03464

EFFECTS OF ACUTE EXPOSURE TO SUBLETHAL CONCENTRATIONS OF CADMIUM ON THE THERMAL RESISTANCE OF THE MUMMICHOG,
South Carolina Univ., Columbia. Belle W. Baruch Coastal Research Inst.; and South Carolina Univ., Columbia. Dept. of Biology.
C. L. McKenney, Jr., and J. M. Dean.
In: Thermal Ecology, CONF-730505, Proceedings of a Symposium held at Augusta, Georgia May 3-5, 1973. p 43-53, 6 fig, 26 ref.

Descriptors: *Thermal pollution, *Water pollution effects, *Cadmium, *Fish, Resistance.
Identifiers: Sublethal concentrations, Acute exposure, Mummichogs, Fundulus heteroclitus.

Acute exposures to sublethal concentrations as low as 10% of the LD sub 50 value of cadmium reduced the thermal resistance of the mummichog, Fundulus heteroclitus, throughout its temperature range. At all test temperatures fish acclimated at 10, 20 and 30 degrees C and exposed to 56 mg of cadmium per liter for 24 hours had thermal resistance times significantly lower than those of control fish. Exposure to 28 and 14 mg of cadmium per liter for 24 hours affected thermal resistance of the fish as a function of acclimation temperature. A more striking reduction in thermal resistance was observed in those fish exposed to 20% of the LD sub 50 concentrations of cadmium for 24 hours and acclimated at 10 degrees C than those fish exposed to the same concentration of cadmium and acclimated at 30 degrees C. Exposure to 10% of the LD sub 50 concentrations of cadmium for 24 hours had no significant effect on the thermal resistance of mummichogs acclimated at 30 degrees C and reduced the median resistance times of mummichogs acclimated at 10 degrees C to a greater extent than it did those of the fish acclimated at 20 degrees C. (See W76-02004) (Chilton-HNL)
W76-03465

SATURATION VALUES OF DISSOLVED GASES ASSOCIATED WITH THE OCCURRENCE OF GAS-BUBBLE DISEASE IN FISH IN A HEATED EFFLUENT,
Duke Power Co., Charlotte, N.C.
W. D. Adair, and J. J. Hains.
In: Thermal Ecology, CONF-730505, Proceedings of a Symposium held at Augusta, Georgia May 3-5, 1973. p 59-78, 3 fig, 7 tab, 18 ref.

Descriptors: *Thermal pollution, *Water pollution effects, *Nitrogen, *Oxygen, *Supersaturation, Fish Diseases, Fish, Temperature, Effluents, Discharge(Water), Flow, Depth, North Carolina.
Identifiers: *Gas-bubble disease.

A study of the concentrations and the corresponding dissolved-oxygen and -nitrogen saturation values associated with the heated effluents from three Duke Power Company steam stations was undertaken after the discovery of gas-bubble disease in fish inhibiting a cove that received heat effluent from one of the stations (Marshall Steam Station). An evaluation of plant operating data showed that the responsibility for the peak incidence of gas-bubble disease in the winter of 1970-1971 was apparently due to a combination of high temperature (resulting in a high degree of supersaturation), plant flow, and depth of discharge outlet. At Marshall the nitrogen supersaturation was highest at the point of discharge and decreased to near-control (or below 110%) levels at a station 3.0 km downstream. Withdrawing water under the skimmer wall did not result in higher than control saturation values at the plant intake structure. (See W76-02004) (Chilton-HNL)
W76-03466

EFFECTS OF THERMAL EFFLUENT ON THE FAT CONTENT OF THE MOSQUITO FISH,
Savannah River Ecology Lab., Aiken, S.C.
J. D. Falke, and M. H. Smith.
In: Thermal Ecology, CONF-730505, Proceedings of a symposium held at Augusta, Georgia May 3-5, 1973. p 100-108, 1 tab, 36 ref. AT(38-1)-310 and AT(38-1)-708 NSF GY-9838.

Descriptors: *Thermal pollution, *Water pollution effects, *Fish, *Food habits, Habitats, South Carolina.
Identifiers: *Fat, *Mosquito fish, Gambusia affinis, Eurythermal species.

Mosquito fish were collected at the Savannah River Plant from seven locations (three areas receiving thermal effluent, one thermal recovery area, and three natural areas) for the purpose of investigating the possible relationships between environmental temperature and fat content of the species. Percentage of fat in each fish was determined and correlated with the log of the dry weight. Females had significantly more fat than males at all locations except one, which had never received thermal effluent. The amount of body fat was found to be a function of the type, quality and amount of energy producing food ingested and assimilated by the fish and did not vary as a function of habitat temperature. (See also W76-02004) (Chilton-HNL)
W76-03467

EFFECTS OF ACUTE COLD SHOCK ON THE CHANNEL CATFISH,
Battelle Pacific Northwest Labs., Richland, Wash. Ecosystems Dept.
R. M. Block.
In: Thermal Ecology, CONF-730505, Proceedings of a symposium held at Augusta, Georgia May 3-5, 1973. p 109-118, 5 fig, 17 ref. AT(45-1)-2042 and AT(45-1)1830.

Descriptors: *Thermal pollution, *Water pollution effects, Channel catfish, Chlorides, Cold resistance.

Identifiers: *Plasma osmolarity, *Glucose, *Cold shock, Chloride ions, Acclimation, Hematocrit.

Channel catfish were acclimated at 30 degrees C and exposed to acute cold shock at 10 degrees C. During the first ten minutes of exposure a slight increase in plasma osmolarity and chloride ions were indicated. There was a rapid decline in osmolarity and chloride concomitant with increased plasma glucose and tissue water after a 24 hour period. After 45 hours of exposure to 10 degrees C, plasma osmolarity decreased 34%, chloride decreased 55% and glucose levels increased 28.1%. The plasma concentrations of glucose, chloride, and osmolarity returned to normal over a four day period when the fish were returned to acclimation temperature. (See also W76-02004) (Chilton-HNL)
W76-03468

BODY-TEMPERATURE CHARACTERISTICS OF FISH AT A THERMAL DISCHARGE ON LAKE MICHIGAN,
Argonne National Lab., Ill.
S. A. Spigarelli, G. P. Romberg, W. Prepejchal, and M. M. Thommes.
In: Thermal Ecology, CONF-730505, Proceedings of a Symposium held at Augusta, Georgia May 3-5, 1973. p 119-132, 4 tab, 3 fig, 15 ref.

Descriptors: *Thermal pollution, *Water pollution effects, *Fish, *Thermal capacity, *Heat transfer, Carp, Trout, Temperature, Stabilization, Discharge, Flumes, *Lake Michigan.
Identifiers: *Equilibration rates, *Body temperature, Chub, Alewives, Coregonus sp., Aloso pseudoharengus.

The rate of change and the time for stabilization of body temperature for five species of Lake Michigan fish experimentally exposed to elevated or reduced temperatures were monitored. The heat-exchange half-times of fish exposed to temperature changes of 4 to 9 degrees C differed greatly between species and were generally proportional to body weight. The internal temperature of trout, chubs, and alewives weighing less than 100 grams required less than 10 minutes total stabilization time while carp weighing approximately 4000 grams required 1 to 2.5 hours total stabilization time. Alewives exposed to both elevated and reduced temperatures required a longer time for cooling than warming. Derived heat-exchange half-times are used to calculate the short-term residence times of fish collected from warm discharge waters. In both elevated- and reduced-temperature experiments, final body temperature of the fish stabilized at a higher temperature than that of the exposure medium. Body temperature measurements made on fish collected from the discharge area reflect substantial behavioral thermoregulation. (See also W76-02004) (Chilton-HNL)
W76-03469

EFFECT OF THERMAL STRESS ON DRAGONFLY NYMPHS,
Birmingham-Southern Coll., Ala.
W. J. Martin, and J. B. Gentry.
In: Thermal Ecology, CONF-730505, Proceedings of a Symposium held at Augusta, Georgia May 3-5, 1973. p 133-145, 2 tab, 4 fig, 31 ref. AT(38-1)-310 and AT(38-1)-708.

Descriptors: *Thermal Tollution, *Water pollution effects, *Dragonflies, Lethal limit.
Identifiers: *Critical *Thermal maximum, Lethal temperaure, *Nymphs, Odonata, Libellula.

Dragonfly nymphs of the genus Libellula were collected from a thermally stressed stream and a control stream and tested for critical thermal maximum (CTM) and lethal temperature (LT). Nymphs were separated into groups and each group was acclimated to a specific temperature (15, 20, 25, 30, or 35 degrees C) and maintained at this acclimation temperature for 24 hours before being tested. Winter water temperatures in the thermal stream ranged from 30 to 33 degrees C and in the control stream from 5 to 12 degrees C. Correlations were found between CTM, LT, and body length at the different acclimation temperatures. The LT for nymphs acclimated at 15 degrees C from the thermal stream was 43.8 degrees C and it increased at a constant rate to 47.7 degrees C for the nymphs acclimated at 30 degrees C, but there was no significant increase for the 35 degree C group. For nymphs from the control stream, the LT of the 15 degree C group was 42.8 degrees C; it declined to 42.1 degrees C for the 25 degree C group and then increased to 45.5 degrees C for the 35 degree C group. Nymphs from the thermal stream were larger than those from the control stream. (See also W76-02004) (Chilton-HNL)
W76-03470

RESISTANCE OF CRAYFISH TO ACUTE THERMAL SHOCK: PRELIMINARY STUDIES,
Battelle Pacific Northwest Labs., Richland, Wash. Ecosystems Dept.
C. D. Becker, and R. G. Genoway.
In: Thermal Ecology, CONF-730505, Proceedings of a symposium held at Augusta, Georgia May 3-5, 1973. p 146-150, 1 fig, 8 ref. AT(45-1)-1830.

Descriptors: *Thermal pollution, *Water pollution effects, *Heat resistance, *Lethal limit, Crayfish, Heat resistance, Temperature.
Identifiers: *Thermal shock, Pacifastacus leniusculus.

Laboratory studies were conducted to determine the resistance of crayfish to acute thermal shock after acclimation at 10, 20, and 30 degrees C. The tolerance of the crayfish to temperature rise declined rapidly at increasing acclimation levels. The crayfish survived exposures for 48 hours to elevated temperatures up to about temperature rise of 19 degrees C when acclimated at 10 degrees C, a temperature rise of about 10 degrees C when acclimated at 20 degrees C, and temperature rise of only 1 to 2 degrees C when acclimated at 30 degrees C. (See also W76-02004) (Chilton-HNL)
W76-03471

CHRONIC MALNUTRITION IN FOUR SPECIES OF SUNFISH IN A THERMALLY-LOADED IMPOUNDMENT,
North Carolina Univ., at Asheville. Dept. of Biology.
T. P. Graham.
In: Thermal Ecology, CONF-730505, Proceedings of a Symposium held at Augusta, Georgia May 3-5, 1973. p 151-157, 1 fig, 2 tab, 18 ref. NSF GY-9129 AT-38-1-(310).

Descriptors: *Thermal pollution, *Water pollution effects, *Metabolism, *Food abundance, Sunfishes, *North Carolina, Impoundments, Heated water, Heat resistance.
Identifiers: *Malnutrition, *Starvation, Lepomis, *Lake Julian(NC).

Fish from a thermally stressed section of Lake Julian in North Carolina were found to be congregating in spring fed coves and to be suffering from chronic malnutrition while those from the nonthermally stressed section of the impoundment were not suffering from malnutrition. It was suggested that fish from the thermally stressed section left for cooler waters in early summer with some fish entering spring cooled coves having initially a good food supply. Rising water temperatures prevented the fish from leaving the coves as the food supply dwindled so that a large proportion were stranded to starve. As starvation became more pronounced, the fishes ability to successfullly leave for cooler waters became more diminished because of increased metabolic stress at higher temperatures. (See also W76-02004) (Chilton-HNL)
W76-03472

EFFECTS OF THREE HEATING RATES ON THE CRITICAL THERMAL MAXIMUM OF BLUEGILL,
Oak Ridge National Lab., Tenn. Environmental Sciences Div.
D. K. Cox.
In: Thermal Ecology, CONF-730505, Proceedings of a symposium held at Augusta, Georgia May 3-5, 1973. p 158-163, 2 tab, 11 ref.

Descriptors: *Thermal pollution, *Water pollution effects, *Heating, *Rates, Fish, Temperature, Resistance, *Sunfishes.
Identifiers: *Critical thermal maximum, Lepomis macrochirus, Acclimation.

Critical thermal maximum was used to determine if bluegill acclimated to a particular temperature exhibit significantly different levels of thermal tolerance when they are subjected to different constant rates of temperature elevation. The fish were acclimated to 26 degrees C for a minimum of 14 days and subjected to temperature elevation rates of 0.1, 0.5, and 1.0 degrees C per minute. Temperatures at which loss of equilibrium and cessation of opercular beating occurred were chosen as end points. Slower rates of heating produced lower mean end-point temperatures. Large bluegill subjected to heating rates of 1.0 to 0.1 degrees C per minute lost equilibrium sooner but maintained opercular beating longer than small fish. Higher mean end-point temperatures were achieved at the faster rates of heating because the dying rate did not keep pace with the rapid heating of the external media. (See also W76-02004) (Chilton-HNL)
W76-03473

RELATIVE SENSITIVITY OF DIFFERENT DEVELOPMENTAL STAGES OF CARP EGGS TO THERMAL SHOCK,
Oak Ridge National Lab., Tenn. Environmental Sciences Div.
M. L. Frank.
In: Thermal Ecology, CONF-730505, Proceedings of a symposium held at Augusta, Georgia May 3-5, 1973. p 171-176, 2 tab, 6 ref.

Descriptors: *Thermal pollution, *Water pollution effects, *Thermal stress, *Embryonic growth stage, Damages, *Carp, Fish eggs.

The effects of acute thermal shock on the development of carp eggs with particular emphasis on the relationship between thermal sensitivity and their stage of development was investigated. Control eggs were maintained at 25 degrees C and experimental groups of eggs were exposed to tempreratures of 35, 37.5, 40, 42.5, and 45 degrees C for 10 minute periods. Eggs exposed to 42.5 and 45 degrees C did not develop. The response of eggs exposed at other experimental temperatures depended upon their stage of development at the time of thermal shock. The thermal limit for newly fertilized eggs was approximately 35 degrees C, and for embryos in late stages of development, between 40 and 42.5 degrees C. The eggs were more susceptible to thermal damage in the cleavage and blastopore-closing stages than at any other stage. (See also W76-02004) (Chilton-HNL)
W76-03474

PRELIMINARY STUDIES ON THE EFFECT OF FATIGUE ON THERMAL TOLERANCE OF RAINBOW TROUT,
Battelle Pacific Northwest Labs., Richland Wash.
M. J. Schneider, R. G. Genoway, and S. A. Barraclough.
In: Thermal Ecology, CONF-730505, Proceedings of a Symposium held at Augusta, Georgia May 3-5, 1973, p 177-185, 2 fig, 2 tab, 8 ref.

Descriptors: *Thermal pollution, *Water pollution effect, *Thermal stress, Resistance, *Rainbow trout, Temperature.
Identifiers: *Fatigue, *Blood, *Lactic acid, Glucose, Cold shock, Immobilization.

Concentrations of blood lactic acid and blood glucose in a fish in a resting state served as a base-line measurement for comparisons of the combined effects of temperature and fatigue. Cold shock was used as a means of immobilization. Rainbow trout were exposed to elevated water temperature (27 degrees C) for 3 min and returned to acclimation temperature (4.3 degrees C). Blood samples were obtained at the end of the exposure time and at 5 min. intervals for a period of 1 hour. The time of appearance of lactic acid and glucose showed large fluctuations in concentrations. (See also W76-02004) (Chilton-HNL)
W76-03475

RESPONSES OF PLANKTONIC CLADOCERANS TO HEATED WATERS,
Cornell Univ., Ithaca, N. Y. Dept. of Natural Resources.
D. M. Carlson.
In: Thermal Ecology, CONF-730505, Proceedings of a symposium held at Augusta, Georgia May 3-5, 1973. p 186-206, 7 fig, 4 tab, 18 ref.

Descriptors: *Thermal pollution, *Water pollution effects, *Zooplankton, *Heat resistance, *Biological communities, Plankton, Aquatic populations, Bioassay, Crustaceans, Mortality, New York, outh Carolina.
Identifiers: *Cladocerans, Scapholeberis kingi, Acclimation temperatures.

Populations of pond zooplankton were reared and studied at elevated temperatures. The plankton responded to heat through changes in turnover rate, changes in species composition, and mortality. Of the five communities reared outdoors for 35 days, treatment at mean temperature of 25 degrees C, or 4.8 degrees C above the ambient water temperature, had the greatest crustacean diversity and density. Reduction in community density was seen at 13.5 degrees C above ambient and at 20.8 degrees C above ambient, 100% mortality occurred within 6 days. The upper thermal limits of Scapholeberis kingi were studied in populations from a pond in Ithaca, New York and from a heated pond near Aiken, South Carolina. Different heating rates and different acclimation temperatures resulted in only minor differences in estimated thermal resistance. Though there was no notable difference in the upper limit of the zone of thermal tolerance for the New York and South Carolina populations, there was an extended survival time of some of the South Carolina animals. (See also W76-02004) (Chilton-HNL)
W76-03476

EFFECTS OF THERMAL EFFLUENT ON THE POPULATION DYNAMICS OF HELMINTH PARASITES IN LARGEMOUTH BASS,
Savannah River Ecology Lab., Aiken, S. C.
H. E. Eure, and G. W. Esch.
In: Thermal Ecology, CONF-730505, Proceedings of a symposium held at Augusta, Georgia May 3-5, 1973. p 207-215, 4 fig, 3 tab, 16 ref. USAEC AT(38-1)-310.

Descriptors: *Thermal pollution, *Water pollution effects, *Fish parasite, *Seasonal, *Heated water, Population, Water temperature, Worms, Bass, Infection, Nematodes, Trematodes, South Carolina.
Identifiers: *Micropterus salmoides, *Acanthocephalan, Neoechinorhynchus cylindratus, Tapeworm.

Season cycling of incidence and intensity of infection in largemouth bass by helminth parasites in a pond having temperature regimes which ranged from normal to greater than 10 degrees C above normal was studied. The parasites exhibited a definite seasonal change in intensity of infection but not in incidence of infection with the pattern being most apparent for the acanthocephalan, Neoechinorhynchus cylindratus. Levels of infection for the tapeworm, nematode, and trematode populations were lower than those of the acanthocephalan populations. Relatively reduced parasite loads appeared in all fish from June through October with maximum worm loads appearing in December through March. The number of parasites per host was higher in fish taken from areas with elevated water temperatures. Worm burdens were higher in female hosts than in males. (See also W76-02004) (Chilton-HNL)
W76-03477

THERMAL REGIME ALTERATION AND VITAL ENVIRONMENTAL PHYSIOLOGICAL SIGNALS IN AQUATIC ORGANISMS,
Saskatchewan Univ., Saskatoon. Dept. of Biology.
D. M. Lehmkuhl.
In: Thermal Ecology, CONF-730505, Proceedings of a symposium held at Augusta, Georgia, May 3-5, 1973. p 216-222, 4 fig, 12 ref.

Descriptors: *Thermal pollution, *Water pollution effects, *Physiological ecology, *Life cycles, Life history studies, Temperature, Thermal stratification, Growth stages, Growth rates, Food chains, Mayflies, Reproduction, Seasonal, Aquatic animals.
Identifiers: *Ephemeroptera.

Life-cycle and reproductive data of some species of Ephemeroptera are examined to demonstrate the dependence of the insects upon key temperatures to initiate embryological development, signal eclosion from the egg, control the rate of growth, and stimulate emergence of adults. Lack of or abnormal timing or signals, as a result of a reservoir, exterminated most of the intermediate members of a food chain up to 70 miles downstream from the reservoir. (See also W76-02004) (Chilton-HNL)
W76-03478

EFFECTS OF THERMAL EFFLUENT ON POPULATIONS OF MOSQUITO FISH,
Savannah River Ecology Lab., Aiken, S.C.
M. C. Ferens, and T. M. Murphy, Jr.
In: Thermal Ecology, CONF-730505, Proceedings of a symposium held at Augusta, Georgia May 3-5, 1973. p 237-245, 1 tab, 2 fig, 14 ref. AT(38-1)-310 and AT(38-1)-708.

Descriptors: *Thermal pollution, *Water pollution effects, *Fish populations, *Size, *Reproduction, Sexual maturity, Secondary productivity, Water temperature, Fish.
Identifiers: *Gambusia affinis, *Mosquito fish, Embryos.

Populations of mosquito fish from environments with different thermal conditions were examined to determine reproduction, sex ratios, and size structure. Fish were collected over a short period (from February 20 to March 3, 1973) to minimize seasonal effects on the breeding cycle. Water temperatures at the time of sampling ranged from 16.5 degrees C in a pond receiving no thermal effluent to 44 degrees C in a heated pond. Sex ratios varied from 0.24 (males) to 4.40 (females) but did not appear to vary with water temperature. The percentage of females 30 mm or more in length bearing eyed embryos increased linearly with water temperature. Size structure was also altered with increasing water temperature. The most significant difference in populations inhabitating nonheated and heated waters was the increased secondary productivity in heated areas. (See also W76-02004) (Chilton-HNL)
W76-03479

GROWTH AND CONDITION OF JUVENILE LARGEMOUTH BASS FROM A RESERVOIR RECEIVING THERMAL EFFLUENT,
Savannah River Ecology Lab., Aiken, S. C.
D. H. Bennett, and J. W. Gibbons.
In: Thermal Ecology, CONF-730505, Proceedings of a symposium held at Augusta, Georgia May 3-5, 1973. p 246-254, 2 fig, 2 tab, 12 ref. USAEC AT(38-1)-310.

Descriptors: *Thermal pollution, *Water pollution effects, *Juvenile fish, *Growth rates, Bass, Water temperature, South Carolina.
Identifiers: *Body condition, *Micropterus salmoides.

Juvenile largemouth bass were collected from a reservoir near Aiken, South Carolina which receives thermal effluent from a nuclear reactor at weekly intervals from May through October in 1969 and from April through September in 1970. Mean surface temperatures in a cove receiving thermal effluent were greater than temperatures in nonheated areas by 7 degrees C in 1969 and 3 degrees C in 1970. Juvenile bass collected at the heated station grew faster than young bass of similar age living in nonheated-area temperatures. Condition factors of bass from heated and nonheated areas were generally similar except during May and July 1969 and June 1970 when condition factors were higher in bass from the heatd station. (See also W76-02004) (Chilton-HNL)
W76-03480

BIOCHEMICAL GENETICS OF SUNFISH III. GENETIC SUBDIVISION OF FISH POPULATIONS INHABITATING HEATED WATERS,
Savannah River Ecology Lab., Aiken, S. C.
D. Yardley, J. C. Avise, J. W. Gibbons, and M. H. Smith.
In: Thermal Ecology, CONF-730505, Proceedings of a symposium held at Augusta, Georgia May 3-5, 1973, p 255-263. 1 fig, 2 tab, 19 ref. AT(38-1)-310 and AT(38-1)-708.

Descriptors: *Thermal pollution, *Water pollution effects, *Genetics, *Sunfishes, Heated water, Lentic environment, Lotic environment, Bass, South Carolina.
Identifiers: *Allele frequency, Mosquito fish.

About 20 loci were electrophoretically examined in largemouth bass, mosquito fish, and bluegill for evidence of genetic changes associated with their inhabitating waters receiving thermal effluent. Comparisons were made between populations in lentic and lotic waters receiving thermal effluent, in post thermal areas, and in natural areas. There were no clear effects of thermal effluent on allele or genotype frequency. There was significant regional genetic heterogeneity and two species showed significant differences in allele frequencies between lentic and lotic environments. (See also W76-02004) (Chilton-HNL)
W76-03481

ENHANCED GROWTH AND INCREASED BODY SIZE OF TURTLES LIVING IN THERMAL AND POST-THERMAL AQUATIC SYSTEMS,
Savannah River Ecology Lab., Aiken, S. C.
E. J. Christy, J. O. Farlow, J. E. Bourque, and J. W. Gibbons.
In: Thermal Ecology, CONF-730505, Proceedings of a symposium held at Augusta, Georgia May 3-5, 1973, p 277-284. 4 fig, 10 ref. AT(38-1)-310.

Descriptors: *Thermal pollution, *Water pollution effects, *Chemical wastes, *Growth rates, *Size, Environmental effects, Turtles, Aquatic environment.
Identifiers: *Chemical pollution, *Body size, Pseudemys scripta.

Yellow-bellied turtles from four types of habitat: (1) natural areas receiving no thermal effluent; (2) aquatic areas receiving heated effluents; (3) post-thermal recovery habitats; and (4) a chemically polluted pond were examined for population size structure and individual growth rates. In these thermally and chemically altered environments both the nutrient balance and the community structure had been altered. Turtles from the thermal and post-thermal areas attained larger body sizes than those from natural habitats. Turtles from the thermally and chemically affected areas

grew faster than those from natural areas. Post-thermal environments continued to reflect changes in growth rates and body sizes for as long as 9 years after the last thermal input. (See also W76-02004) (Chilton-HNL)
W76-03482

VERTICAL MOVEMENT OF ZOOPLANKTON IN RESPONSE TO HEATED WATER,
Oak Ridge National Lab., Oak Ridge, Tenn. Environmental Sciences Div.
C. W. Gehrs.
In: Thermal Ecology, CONF-730505, Proceedings of a symposium held at Augusta, Georgia May 3-5, 1973, p 285-290. 1 fig, 1 tab, 8 ref.

Descriptors: *Thermal pollution, *Water pollution effects, *Zooplankton, *Thermocline, *Movement, Laboratory tests, Productivity.
Identifiers: *Vertical movement, Diaptomus sanguineus, Daphnia parvula.

Laboratory tests on Diaptomus sanguineus and Daphnia parvula were conducted to study individuals vertical locomotory response to heated water. Two tests were conducted for each species, one with initial water temperature at 21 degrees C and one at 15 degrees C. The zooplankton were acclimated at initial temperature for a minimum of 14 days. In the test apparatus all animals were observed to move to a deeper level when the water temperature at which they resided was increased 2 degrees C. Investigators conclude that thermal discontinuity can act as a deterrent to the vertical movement of zooplankton, which could result in decreased productivity. (See also W76-02004) (Chilton-HNL)
W76-03483

DISTRIBUTION OF ALLIGATORS IN RESPONSE TO THERMAL GRADIENTS IN A REACTOR COOLING RESERVOIR,
Savannah River Ecology Lab., Aiken, S. C.
T. M. Murphy, Jr., and I. L. Brisbin, Jr.
In: Thermal Ecology, CONF-730505, Proceedings of a symposium held at Augusta, Georgia May 3-5, 1973, p 313-321. 1 tab, 3 fig, 13 ref. USAEC AT(38-1)-310.

Descriptors: *Thermal pollution, *Water pollution effects, *Seasonal, *Distribution, Census, South Carolina, *Animal behavior.
Identifiers: *Alligators, *Abundance index.

Seasonal fluctuations in the distribution of American alligators inhabitating heated and unheated portions of a reactor cooling reservoir, were investigated. Abundance indexes (calculated from 4 years of daylight head counts) conducted three times a month were combined with counts from 1 year of weekly night cruises. The mean annual alligator head-count index for the heated area was more than twice that for the unheated area. The seasonal fluctuation of the abundance indexes at each counting site was striking and the higher yearly mean of the heated area appeared to be due to increased values during the winter months in that area. The unheated area showed a tendency to peak during warmer months, but this tendency was not so pronounced as that observed in the heated area during colder months. Decreasing water temperatures in the fall appeared to stimulate movement of the animals throughout the reservoir. Animals that encountered warmer waters apparently restricted their movements to these heated areas. (See also W76-02004) (Chilton-HNL)
W76-03484

EFFECTS OF ABNORMAL TEMPERATURES ON ALGAL COMMUNITIES,
Academy of Natural Sciences of Philadelphia, Pa.
R. Patrick.
In: Thermal Ecology, CONF-730505, Proceedings of a symposium held at Augusta, Georgia May 3-5, 1973, p 335-349. 3 tab, 56 ref.

Descriptors: *Thermal pollution, *Water pollution effects, *Algae, Aquatic habitats, *Biological communities, Temperature, Heated water, Resistance, Phytoplankton, On-site investigations, Reviews.
Identifiers: *Algal communities, *Tolerance range, Literature review.

Field studies below the warm water discharges of power plants confirmed literature review information that diversity and biomass may be increased by small temperature increases but temperature shifts toward the upper limits of the tolerance range and beyond bring about a shift in species composition. Shock exposure to high temperatures or exposure extended for several hours can have adverse effects on algae. Even moderate increases accompanied by other stresses may have severe effects. Where the percentage of water entrained is relatively small compared to the total volume of water, effects on the phytoplankton may appear to be negligible due to the patchiness of the phytoplankton distribution, the mixing of the discharge water with the receiving water, and ecological variables. (See also W76-02004) (Chilton-HNL)
W76-03485

IMPACT OF PRODUCTION-REACTOR EFFLUENTS ON VEGETATION IN A SOUTHEASTERN SWAMP FOREST,
Savannah River Ecology Lab., Aiken, S.C.
R. R. Sharitz, J. W. Gibbons, and S. C. Gause.
In: Thermal Ecology, CONF-730505, Proceedings of a symposium held at Augusta, Georgia May 3-5, 1973, p 356-362. 2 fig, 1 tab, 6 ref. AT(38-1)-310 and AT(38-1)-708.

Descriptors: *Thermal pollution, *Water pollution effects, *Vegetation, *Temperature, *Sediments, *Swamps, *Flood damage, Silts, Ecosystems, Biological communities, Hardwood, South Carolina.
Identifiers: *Tree kill, Bald cypress, Tupelo gum.

The discharge of heated reactor effluents into streams entering the Savannah River Plant swamp has resulted in tree mortality throughout two-thirds of the swamp. In the deltas of the tributary streams, water temperatures may be as high as 25 degrees C above normal. The release of reactor effluents not only elevated the water temperatures in portions of the swamp but also raised the water level throughout much of the swamp. Portions of the stream deltas in which both extensive flooding and silt deposition occur comprise more than half the area of total tree kill. The studies include determination of the flooding and thermal tolerance levels of the various species, of the effects upon species composition and diversity, and of the alteration of the competitive interaction among the species. (See also W76-02004) (Chilton-HNL)
W76-03486

MANGROVE-ROOT COMMUNITIES IN A THERMALLY ALTERED AREA IN GUAYANILLA BAY, PUERTO RICO,
Puerto Rico Nuclear Center, Mayaguez.
S. Kolehmainen, T. Morgan, and R. Castro.
In: Thermal Ecology, CONF-730505, Proceedings of a symposium held at Augusta, Georgia May 3-5, 1973, p 371-390. 7 tab, 7 fig, 17 ref. USAEC AT-(40-1)-4070.

Descriptors: *Thermal pollution, *Water pollution effects, *Biological communties, *Biomass, Aquatic animals, Aquatic algae, *Mangrove swamps, *Heated water, Intertidal areas, Resistance, Invertebrates, *Puerto Rico, Crabs, Mussels, Bays.
Identifiers: Barnacles, Polychaetes, Sponges, Tree oysters, Bryzoans, Coelenterates, Echinoderms, Ascidians, *Guayanilla Bay(PR).

The species composition and biomass of organisms in mangrove-root communities reflected the effects of elevated temperatures in a thermally loaded bay on the south coast of Puerto Rico. During the summer, the number of species varied from 25 to 96 at different stations with water temperatures ranging from 31 to 40 degrees C. In winter, less tolerant species migrated to the warmest stations where the temperature ranged from 33 to 35 degrees C. Some more resistance species, blue green algae, barnacles, a polychaete, a sponge, a mussel, and a bryozoan were found in temperatures above 37 degrees C. The least temperature tolerant groups were the macroalgae, coelenterates, echinoderms, and ascidians. Organisms living on the mangrove roots had a distinct vertical zonation in both species distribution and biomass. A majority of the organisms were found just below the intertidal zone. (See also W76-02004) (Chilton-HNL)
W76-03487

WINTER FAUNA IN A THERMAL DISCHARGE WITH OBSERVATIONS ON A MACROBENTHOS SAMPLER,
Virginia Inst. for Scientific Research, Richmond.
M. D. Dahlberg, and J. C. Conyers.
In: Thermal Ecology, CONF-730505, Proceedings of a symposium held at Augusta, Georgia May 3-5, 1973, p 414-422. 1 fig, 2 tab, 27 ref.

Descriptors: *Thermal pollution, *Water pollution effects, *Sampling, *Benthic fauna, Heated water, Invertebrates, Aquatic animals, *Virginia.
Identifiers: *James River(Va), Macroinvertebrates.

The influence of a thermal discharge on the fauna in the James River, Virginia, and the effectiveness of a benthic sampling device for monitoring freshwater macroinvertebrates were examined. Samplers, constructed of a barbecue basket containing cinder-block chips and conservation cloth, were suspended in the water for 26 days during the winter. The variety and abundance of benthic organisms collected were greater than were found in bottom samples at the same stations. Numbers of species and abundance of benthic macroinvertebrates increased as average temperature increased. Thermal discharges were shown to be potentially a source of enhancement of fish production because the relative availability of food is high in the plumes. Seventeen species of fish were more abundant in the plume than at ambient-temperature stations. (See also W76-02004) (Chilton-HNL)
W76-03488

HEAT INFLUENCES IN ESTUARINE ECOSYSTEMS,
North Carolina State Univ., Raleigh. Dept. of Zoology.
B. J. Copeland, R. W. Laney, and E. C. Pendleton.
In: Thermal Ecology, CONF-730505, Proceedings of a symposium held at Augusta, Georgia May 3-5, 1973, p 423-437. 5 fig, 4 tab, 8 ref.

Descriptors: *Thermal pollution, *Water pollution effects, *Estuarine environment, Ecosystems, Biomass, Algae, Aquatic life, Growth rates, Heated water, Resistance, Salinity, Size.
Identifiers: *Critical thermal maximum, *Photosynthesis/respiration ratios, *Acclimation temperature, Food conversion, Assimilation, Species.

Laboratory and field studies were conducted to measure ecosystem structure and productivity under controlled conditions. Thermal loading was regulated at 5 degrees C above ambient temperature. Higher biomass and photosynthesis/respiration ratios were apparent in the heated estuaries during spring but lower in summer with no significant differences in the winter. Investigations into the relationship of temperature to growth, food conversion, and assimilation efficiency showed that growth and feeding efficiency were directly related to increases in temperature.

The critical thermal maximum of the croaker and the penaeid shrimp was significantly related to acclimation temperature with lesser effects associated with salinity, size and species. (See also W76-02004) (Chilton-HNL)
W76-03489

EFFECT OF THERMAL STRESS ON PHYTOPLANKTON PRODUCTIVITY IN CONDENSER COOLING WATER,
North Carolina University. Dept. of Environmental Sciences and Engineering.
M. E. Gurtz, and C. M. Weiss.
In: Thermal Ecology, CONF-730505, Proceedings of a symposium held at Augusta, Georgia May 3-5, 1973, p 490-507. 9 fig, 2 tab, 20 ref.

Descriptors: *Thermal pollution, *Water pollution effects, *Productivity, *Phytoplankton, *Thermal stress, Cooling water, Condensers, Growth, Photosynthesis, Temperature, *North Carolina.
Identifiers: *Lake Wylie(NC).

Samples of phytoplankton were collected before and after passage through a condenser at levels of temperature rise of 5.6, 11.1 and 16.7 degrees C on six dates. Productivity was measured at several intervals during the cooling period and a final determination was made at the end of a 26 hour period. Maximum inhibition of productivity occurred during the first 1 to 2 hours of cooling, and neither further inhibition nor recovery was observed during the remainder of the 26 hour cooling period. Lake phytoplankton acclimated to low winter temperatures survived a greater sudden rise in temperature and the subsequent period of thermal stress than did summer phytoplankton in the same lake. (See also W76-02004) (Chilton-HNL)
W76-03490

POPULATION ECOLOGY OF PARASITES IN TURTLES FROM THERMALLY ALTERED AND NATURAL AQUATIC COMMUNTIES,
Savannah River Ecology Lab., Aiken, S.C.
J. E. Bourque, and G. W. Esch.
In: Thermal Ecology, CONF-730505, Proceedings of a symposium held at Augusta, Georgia May 3-5, 1973, p 551-561. 4 tab, 3 tab, 19 ref. AT(38-1)-310.

Descriptors: *Thermal pollution, *Water pollution effects, Population, *Animal parasites, *Biological communties, Turtle, Heated water, Ponds, Swamps, Trematodes, Nematodes, Natural streams, Ecology, South Carolina.
Identifiers: Acanthocephalans, Pseudemys s. scripta, Species diversity.

Turtles from natural, thermally altered, and post-thermal recovery ponds and river swamps were collected and compared in terms of percent incidence of parasitic infection, frequency distribution of the infection, and mean parasite burden. The extent of parasitism in host populations varied among different types of habitat as did the number of parasites per infected host. In natural areas, nematodes were prevalent in the populations from ponds but the incidence and worm burden for nematodes was significantly lower in hot ponds and increased in heated river swamps. Trematodes appeared to be adversely affected in areas receiving heated effluent regardless of habitat type. The number of Acanthocephala per host increased in all heated habitats. (See also W76-02004) (Chilton-HNL)
W76-03491

EFFECT OF THERMAL EFFLUENTS FROM NUCLEAR REACTORS ON SPECIES DIVERSITY OF AQUATIC INSECTS,
Savannah River Estuary Lab., Aiken, S. C.
F. G. Howell, and J. B. Gentry.
In: Thermal Ecology, CONF-730505, Proceedings of a symposium held at Augusta, Georgia May 3-5, 1973, p 562-571. 4 fig, 1 tab, 17 ref. AT(38-1)-310 and AT(38-1)-708.

Descriptors: *Thermal pollution, *Water pollution effects, *Aquatic insects, *Census, *Biological communities, Sampling, Estimating, Mayflies, Stoneflies, South Carolina.
Identifiers: *Species diversity, *Evenness, Ephemeropterans, Odonates, Plecopterans, Trichopterans.

Aquatic insects were collected from stations along the edge of thermal, post-thermal, and natural streams on the Savannah River Plant site near Aiken, South Carolina. The insects were compared according to species composition and diversity. Plecopterans, odonates, ephermeropterans and trichopterans showed a trend of increasing importance in both numbers of individuals and numbers of species from thermal to post-thermal to natural streams. In the natural stream aquatic insect associations are characterized by high diversity and high evenness. In the thermal stream the associations are characterized by low diversity estimates and low evenness estimates. The associations sampled in the post-thermal stream showed intermediate values of both diversity and evenness and indicated that the stream is in a successional stage. Species diversity and evenness estimates appeared to be reliable indicators of environmental stress. (See also W76-02004) (Chilton-HNL)
W76-03492

BIRD DIVERSITY AND THERMAL STRESS IN A CYPRESS SWAMP,
Savannah River Ecology Lab., Aiken, S. C.
D. O. Straney, L. A. Briese, and M. H. Smith.
In: Thermal Ecology, CONF-730505, Proceedings of a symposium held at August, Georgia May 3-5, 1973, p 572-578. 3 tab, 9 ref. AT(38-1)-310 and AT(38-1)-708.

Descriptors: *Thermal pollution, *Water pollution effects, *Birds, *Vegetation, *Nesting cover, *Swamps, Foods, Heated water, Biological communities, Census, *Thermal stress, South Carolina.
Identifiers: *Species diversity.

The study documents the effect of thermal effluents on bird populations in a cypress swamp and the status of bird populations in a post-thermal recovery situation. Variances increase in thermally affected areas but thermal effluents decrease the means of diversity and evenness estimates for bird species in the cypress swamp. Increased numbers of woodpeckers, crows, and herons were found in the thermal swamp. Introduction of thermal effluents produced a large stand of dead trees that serve as nesting and feeding sites for woodpeckers. Small passerines common to the natural areas find limited perching and feeding sites in the sparse vegetation of thermally affected areas. (See also W76-02004) (Chilton-HNL)
W76-03493

ABUNDANCE AND DIVERSITY OF WATERFOWL INHABITING HEATED AND UNHEATED PORTIONS OF A REACTOR COOLING RESERVOIR,
Savannah River Ecology Lab., Aiken, S. C.
I. L. Brisbin, Jr.
In: Thermal Ecology, CONF-730505, Proceedings of a symposium held at Augusta, Georgia May 3-5, 1973, p 579-593. 5 fig, 3 tab, 22 ref. USAEC AT(38-1)-310.

Descriptors: *Thermal pollution, *Water pollution effects, *Resistance, *Waterfowl, Census, Heated water, Foods, Ducks, Reservoirs.
Identifiers: *Species diversity, *Thermal tolerance.

Census counts were made of waterfowl inhabiting both heated and unheated portions of a cooling reservoir receiving heated effluents from a nuclear production reactor. 99% of the birds were counted between the months of October and April. American coots made up over 66% of the identified species. Significant differences were observed in the numbers and species diversity of the waterfowl in the two areas with more birds and a greater species diversity being found in the unheated area. Observed differences in species diversity may be explained by differences in feeding ecology. Diving ducks showed a greater degree of thermal tolerance than dabbling ducks. The pied-billed brebes were counted in equal numbers in both the heated and the unheated areas and thus showed the greatest thermal tolerance of any species observed. (See also W76-02004) (Chilton-HNL)
W76-03494

MODELING THE EFFECTS OF TEMPERATURE CHANGES ON THE ECOLOGY OF THE GARTER SNAKE AND LEOPARD FROG,
Wisconsin Univ., Madison. Dept. of Zoology.
W. P. Porter, and C. R. Tracy.
In: Thermal Ecology, CONF-730505, Proceedings of a symposium held at Augusta, Georgia May 3-5, 1973, p 594-609. 2 tab, 10 fig, 28 ref. AT(11-1)-2270.

Descriptors: *Thermal pollution, *Water pollution effects, *Model studies, *Temperature, *Biomass, Reproduction, Maintenance, Predation, Seasonal, Food chain, Energy budget, *Snakes, *Frogs, Michigan, South Carolina.
Identifiers: Thamnophis sirtalis, Rana pipiens.

The study evaluates the consequences of climatic change, both natural and man-made, on populations of animals in ecosystems. Energy balances between the physical environment and a predator (the garter snake) and prey (the leopard frog) were used to compute daily and seasonal food requirements and activity times for northern and southern regions of the country. The overlap of daily and seasonal activity times of predator and prey and predator food requirements for the two regions are compared. It was concluded that the total biomass required for all needs requires only occasional predation and biomass for reproduction is about an order of magnitude higher than the biomass needed for maintenance. It was found that thermal modification might affect biomass requirements for ectotherm maintenance by as much as 50% and might alter birth or death rates, longevity, egg or larval survival, parasite loading, or time of prey abundance vs. time of predator reproduction. (See also W76-02004) (Chilton-HNL)
W76-03495

ENERGY COST-BENEFIT MODELS FOR EVALUATING THERMAL PLUMES,
Florida Univ., Gainesville. Dept. of Environmental Engineering Sciences.
H. T. Odum.
In: Thermal Ecology, CONF-730505, Proceedings of a symposium held at Augusta, Georgia May 3-5, 1973, p 628-648. 12 fig, 4 tab, 13 ref. AT(40-1)-4398.

Descriptors: *Thermal pollution, *Water pollution effects, *Cost-benefit ratios, *Model studies, Systems models, Productivity, Ecosystems, Heated water, Cooling towers, Adaptation.

Energy-circuit models, calculations and simulations are used to consider the work of thermal effluents. The potential energy content of heat flows in an estuary is calculated as an auxiliary energy source, and the role of elevated temperature is considered as affecting productivity and recycling. Energy circuit diagrams and simulations are given for Eyring's model, for Morowitz's order model having autocatalytic temperature action, and for a model with more complex nutrient and sewage recycle actions of temperature. The system's total productivity and useful power may increase as the temperature increases if the temperature rise is accompanied by increased resources with which to interact. Experience with microcosms and measurements at Crystal River, Florida bear out sug-

gestions from models that if the ecosystems are given time for self-designing adaptation, the power plants may have neutral or positive energy impacts on estuarine ecosystems. The negative energy impact of these alternatives may be much less than the energy cost caused by cooling towers. (See also W76-02004) (Chilton-HNL)
W76-03496

5D. Waste Treatment Processes

PROCESS AND APPARATUS FOR RECOVERING CLEAN WATER AND SOLIDS FROM DILUTE AQUEOUS SOLIDS,
Hanover Research Corp., East Hanover, N.J. (Assignee).
C. Greenfield, R. E. Casparian, and A. J. Bonanno.
U S Patent No 3,917,508, 8 p, 2 fig, 13 ref; Official Gazette of the United States Patent Office, Vol 940, No 1, p 375, November 4, 1975.

Descriptors: *Patents, *Waste water treatment, *Waste treatment, Water pollution control, *Evaporation, *Condensation, Water purification, Distillation, *Solid wastes, Drying, Equipment, Waste treatment.

A process and apparatus for recovering clean water and essentially dry solids from dilute aqueous solids is described. A dilute stream of aqueous solids is concentrated by heat evaporation and the evaporated water is condensed and recovered. The concentrated aqueous solids are mixed with relatively non-volatile fluidizing oil and subjected to dehydration by heat evaporation. The steam formed in the dehydration step is used to supply heat for the concentration step. The solids are separated from the fluidizing oil and recovered in an essentially dry state while the fluidizing oil is recycled. If desired, a light, relatively volatile oil may be mixed with the dilute aqueous solids to prevent scaling and fouling in the concentration evaporator. This invention is characterized in that at least a portion of the heat energy of the steam formed by evaporation in the dehydration step is recovered as useful heat within the system. (Sinha-OEIS)
W76-03011

SEWAGE TREATMENT PLANT,
Davis Water and Waste Industries, Inc., Thomasville, Ga. (Assignee).
D. A. King.
U S Patent No 3,917,532, 3 p, 5 fig, 6 ref; Official Gazette of the United States Patent Office, Vol 940, No 1, p 382, November 4, 1975.

Descriptors: *Patents, *Waste water treatment, *Sewage treatment, *Anaerobic digestion, Water pollution control, Aeration, Sludge disposal, Equipment.

A sewage treatment plant has an outer curved wall and an inner curved settling tank wall defining an aeration section with the walls having a common center. Increased sewage capacity of the plant is facilitated in addition to providing adequate mixing of the sewage by air injected into the sewage. A curved intermediate wall located between the inner and outer walls in the aeration section have a common center. An air diffuser provides rolling of sewage in the aeration section, from the intermediate wall toward the outer wall and from the intermediate wall toward the inner wall. The intermediate wall and the inner wall prevent shortcircuiting of sewage from a plant influent to a settling tank influent. (Sinha-OEIS)
W76-03013

COMPOSITIONS FOR THE REMOVAL OF HYDROCARBON AND INDUSTRIAL WASTE BY BIOLOGICAL DEGRADATION,
Banque pour L'Expansion Industrielle 'Banexi', Paris (France). (assignee)
P. Fusey.
United States Patent 3,796,637. Issued March 12, 1974. Official Gazette of the United States Patent Office, Vol 920, No 2, p 470, March, 1974.

Descriptors: *Waste water treatment, *Industrial wastes, *Oil industry, *Patents, Biodegradation, Odor.

Compositions for the removal of polluting industrial effluents, particularly hydrocarbon wastes, have been patented. In order to promote the biological degradation of waste materials while avoiding foul smelling anaerobic fermentation, the compositions used contain from 10% to 40% by weight of an oygenating compound such as a metal oxide or an alkali metal peroxide. The support, such as calcium carbonate, silica, or talc, is chosen on the basis of the pH of the waste material to be treated. Other materials may be added to the compositions, such as nutrient substances for promoting the growth of microorganisms, nitrogenous substances and/or oleophilic substances in the case of compositions for the treatment of hydrocarbons. (Murphy-FIRL)
W76-03059

PETROLEUM PROCESSING AQ. EFFLUENTS PURIFICATION,
A. D. Li, R. G. Norutdinov, and V. P. Tronov.
Soviet Patent SU 371173. Issued May 15, 1973. Soviet Inventions Illustrated, Vol V, No 3, p D2, February, 1974.

Descriptors: *Waste water treatment, *Industrial wastes, *Patents, *Oil industry, Suspended solids, Emulsions, Oil wastes, Oily water.
Identifiers: Refinery wastes.

A process was patented for the purification of petroleum processing waste waters. Emulsified petroleum products are removed from aqueous effluents by contracting them with degasified naphtha. Up to 98% purification is achieved, and additional settling is unnecessary. Contaminated water was passed through degasified naptha in a column (one m layer of naphtha) in the form of small stream (about 2 mm diameter) at a speed of 1.0-1.5 m/hour. The content of petroleum products in the aqueous effluent was reduced from 50-650 mg/liter to 5-8 mg/liter, and the content of suspended solids was reduced from 53-56 mg/liter to 30-47 mg/liter. (Murphy-FIRL)
W76-03060

ACID WASTES ARE LICKED.
Water and Wastes Engineering, Vol 11, No 3, p 16, March, 1974.

Descriptors: *Waste water treatment, *Industrial wastes, *Mining, *Acid mine drainage, Sludge, Waste water disposal, Chemical precipitation, Metals, Patents.
Identifiers: Pickling wastes, Metal finishing wastes.

A possible solution to the problem disposal of acid mine drainage and steel mill waste waters from acid pickling operations has been developed by Bethlehem Steel's research department. This newly patented method consists of collecting precipitated metal compounds in the form of a dense, easily handled sludge containing 15% to 50% solids. A controlled portion of the high-density sludge formed during the process is recycled, then mixed with an alkali-water slurry in a reactor. The mixture, containing the waste water, is passed to a second reactor where the acidity is neutralized by the alkali-water slurry, and metal compounds are precipitated. A settling tank receives the neutralized mixture, and the precipitated metal compounds settle out to form the high-density sludge. Clear water is then decanted from the settling tank. (Murphy-FIRL)
W76-03062

STUDY ON WASTE WATER TREATMENT WITH CALCIUM SILICATES (I) ON THE REMOVAL OF CD(-), PB(-), CR(-) SALTS, (IN JAPANESE),
I. Tohyama, T. Ueda, T. Nakamura, and K. Komatsu.
Bulletin of the Government Industrial Research Institute (Osaka), Vol 24, No 4, p 294-298, December, 1973. 3 fig, 3 tab, 6 ref.

Descriptors: *Waste water treatment, *Industrial wastes, *Heavy metals, *Chemical precipitation, Adsorption, Ion exchange, *Cadmium, *Lead, *Chromium.
Identifiers: Calcium silicates.

Calcium silicates have been used successfully for the removal of cadmium, lead and chromium salts in waste water. This study provided the following results on the use of calcium silicates for heavy metals removal. The capturing capacities for Cd, Pb and Cr salts were increased in the order of xonotlite, tobermorite and CSH(N). The capturing capacity of CSH(N) (tobermorite gel, large surface area) which was prepared under the conditions of low temperature and short reaction time for the described metals was 99.99% (five grams of CSH(N), 0.02 M solution of Cd and Pb and 0.1 M solution of Cr salts). It is assumed that this method is based on the precipitation of hydroxides and adsorption such as chemical fixing, ion exchange or complexing action. (Murphy-FIRL)
W76-03065

REVERSE OSMOSIS TREATMENT OF ELECTROPLATING WASTES,
Abcor, Inc., Cambridge, Mass.
R. G. Donnelly, R. L. Goldsmith, K. J. McNulty, and M. Tan.
Plating, Vol 61, No 5, p 432-442, May, 1974. 12 fig, 12 tab, 8 ref.

Descriptors: *Waste water treatment, *Industrial wastes, *Reverse osmosis, *Water reuse, *Recycling, Membrane processes, Closed conduits, Membranes.
Identifiers: Zero discharge, *Electroplating wastes, Cellulose acetate membranes.

The reverse osmosis treatment of plating bath rinse waters was examined. Emphasis was placed on closed-loop operation with recycle of purified water for rinsing, and return of plating chemical concentrate to the bath. Three commercially available membrane configurations were evaluated experimentally including tubular (cellulose acetate membrane), spiral-wound (cellulose acetate membrane), and hollow-fiber (polyamide membrane) configurations. Tests were conducted with nine different rinse waters prepared by dilution of actual plating baths. Advantages and limitations of the reverse osmosis process and specific membranes and configurations were discussed. (Murphy-FIRL)
W76-03066

ELECTROLYTIC DESTRUCTION OF CYANIDES.
French Patent FR 2190-743, Issued March 8, 1974. French Patents Abstracts, Vol V, No 13, p D6, 1974.

Descriptors: *Waste water treatment, *Industrial wastes, *Patents, Chemical wastes, *Electrolysis, Anodes, Cathodes.
Identifiers: *Cyanides.

A method for the electrolytic destruction of cyanides in waste water and industrial effluents was patented. Waste water containing toxic cyanides is treated by electrolytic oxidation at the anode of an electrolytic cell; the non-toxic cyanate ions, formed by the anodic oxidation of the cyanides are partly reduced at the cathode and cyanide ions may reform. Destruction of the cyanides is thus reduced. The cathode is polarized by the imposi-

tion of a high cathode current density which renders the diffusion level of the cyanate ions negligible. The anodes positioned between cathodes are staggered so that the electrolyte has to circulate in a zig-zag manner. The anodes consist of perforated graphite or solid sheets of platinized Ti. The cathodes are made from sheets of Ti or Cu wires, fixed to a removable plastic frame. The potential difference between the electrodes is 2-10 volts; a cathodic current density greater than 10 amps/sq dn is imposed. (Murphy-FIRL)
W76-03067

POLAROGRAPHIC DETERMINATION OF ARSENIC IN INDUSTRIAL AND DRAINAGE WATERS (POLYAROGRAFICHESKOE OPREDELENIE MYSH'YAKA V PROMYSHLENNYKH I STOCHNYKH VEDAKH),
For primary bibliographic entry see Field 5A.
W76-03068

PROBLEMS OF PROTECTION OF THE ENVIRONMENT (WHEN OPERATING) ETHYLENE PLANTS,
Chemical Economy and Engineering Review, Vol 6, No 2, p 42-45, February, 1974. 1 fig.

Descriptors: *Waste water treatment, *Industrial wastes, *Chemical wastes, Cooling water, Biological treatment, Sedimentation, Neutralization, Water pollution sources.
Identifiers: *Ethylene manufacturing plant wastes.

The undesirable outputs of a typical ethylene plant are discussed. The main source of the highly contaminated waste water is the blowdown of process water vaporizers. This water contains sulfur, chlorine and iron ions as well as phenols, hydrogen cyanide and KMNO4. The condensate of the alcacid respiration, MEA-stripping process, is fed into the sewer system. This water contains hydrocarbons, phenols, sulfur ions, and HCN + HCNS. The blowdown of steam generators is also fed into the sewage system, but is comparatively clean. Condensate of the glycol-stripping process is also added to the waste water stream; this includes hydrocarbons, phenols, exhaust steam residue (105 C), and glow residue (600 C). Blowdown of the cooling water system is highly variable and may be used to dilute the main waste water stream. Caustic soda is another pollution source and may bring with it additional hydrocarbons and phenols. Decoking of furnaces and quenchers contributes coke-like particulates to the waste water stream. Waste water from the bi-yearly regeneration of the hydrogenati on reactors contains large quantities of heavy hydrocarbons and is a further pollution source. Boiler feed water is prepared by running through ion exchange columns and filter beds. When these are recharged by acid treatment significant salt concentrations are released. Biological oxidation will remove the largest part of the harmful dilute organic compounds by bacterial metabolism. Upstream of this stage, sedimentation of hard substances should be allowed and also the settling separation of oil drops and oil films. Neutralization and reduction of inorganic compounds such as sulfides should also be performed prior to the biological oxidation process. (Murphy-FIRL)
W76-03069

APPARATUS FOR AND A METHOD OF PURIFYING WASTE FLUID,
W. J. Didycz, and D. Glassman.
Canadian Patent 945,058, Issued April 9, 1974. The Patent Office Record, Vol 102, No 15, p 1264, April, 1974.

Descriptors: *Waste water treatment, *Industrial wastes, *Chemical wastes, *Patents, Pollution abatement, Air pollution.

A method and an apparatus for purifying waste fluid containing waste water and corrosive salts has been prepared. A substantially salt-free condensate is produced and used to quench coke. This eliminates the contamination of the atmosphere which would occur if the untreated waste fluid were used to quench coke. The process utilizes the waste steam for the useful purpose of reducing the air pollution by quenching coke with condensed industrial pure water. (Murphy-FIRL)
W76-03070

RESIDUAL CHLORINE: SOMETHING NEW TO WORRY ABOUT,
R. Baker, and S. Cole.
Industrial Water Engineering, Vol 11, No 2, p 10-18, March/April, 1974. 7 fig, 15 ref.

Descriptors: *Waste water treatment, *Industrial wastes, *Chemical wastes, Chlorine, Cooling water.
Identifiers: Residual chlorine content.

Until recently residual chlorine discharge was regarded as an innocuous practice. New regulations have now forced greater attention on the fate of such chlorine releases. As a result of experimentation, it appears likely that standards for the release of chlorine into receiving waters will follow one of four criteria. For those areas where chlorine treated wastes are continuously being discharged to receiving waters, the discharge rate should not exceed 0.01 mg/liter for the protection of insensitive species, or no more than 0.002 mg/liter if most aquatic organisms are to be protected. In areas receiving chlorine treated wastes only intermittently, the discharge rate will not be permitted to exceed 0.2 mg/liter for 2 hrs/day to protect hardy species or no more than 0.04 mg/liter for the same period per day if trout and salmon are to be maintained. Cooling water from power plants represents the largest source of intermittent chlorine containing discharge water. The method of reducing residual chlorine depends on the type of system, such as an open once-through system or a recirculating type. Some possible methods include: proper application and control of chlorine; diverting tower blowdown to a secondary use; withholding blowdown during a period based on predictable decay rate; and, chemical dechlorination (with sulfur dioxide). (Murphy-FIRL)
W76-03071

SEPARATION OF WASTE OIL-IN-WATER EMULSIONS.
Belgian Patent BE 807-972, Issued March 15, 1974. Derwent Belgian Patents Report, Vol V, No 15, p D1, 1974.

Descriptors: *Waste water treatment, *Industrial wastes, *Emulsions, *Patents, Oily water, Separation techniques, Electrolytes, Boiling.
Identifiers: Metal rolling wastes.

A technique is described which has been patented for the separation of waste oil-in-water emulsions which contain non-ionic and anionic emulsifiers, such as emulsions from cold rolling processes. These spent emulsions are separated into a usable oil phase and waste water meeting the proper standards by the addition of an electrolyte of pH 4 to 9, followed by heating and boiling. This electrolyte is an aqueous solution of salts, preferably chlorides, of group I and II metals. During boiling, a small quantity of Fe or Al salt, preferably hydrated FeSO4, is added and air is then blown through the emulsion. Boiling is continued until the emulsifiers are destroyed. A clear water layer is separated for disposal, and the oil may be reused in metal tempering. (Murphy-FIRL)
W76-03072

ONE PRIVATE PLANT TREATS OIL, CHEMICAL RESIDUES IN DENMARK,
P. Henriksen.
Solid Wastes Management, Vol 17, No 5, p 77-78, 139, May, 1974.

Descriptors: *Waste water treatment, *Industrial wastes, *Oil wastes, *Chemical wastes, Waste disposal, Incineration, Solid wastes, Costs, *Treatment facilities, Europe.
Identifiers: *Denmark.

Waste oils and chemicals which occur in connection with industrial activity create a problem in handling, treatment, and disposal. In Denmark, where commercial life is a typified by small companies, all the municipalities have banded together to set up a central treatment facility. This facility, called Kommunekemi A/S, has the sole task of converting wastes oils and chemicals to a safely disposal form. Kommunekemi initially was a municipally-owned corporation and is now a privately operated firm under contract to the national government. The installation is located at Nyborg and materials arriving there are sorted into waste oils, solvent discards, refuse for incineration, and inorganic chemical debris, each for separate treatment. Fees collected by Kommunekemi for handling the pollutants have been deemed insufficient to cover operating costs. Studies are now underway to explore whether indirect subsidy from the Danish government would be appropriate. (Murphy-FIRL)
W76-03073

BIOLOGICAL TREATMENTS OF ACID AZO DYES BY MICROBIAL POPULATIONS IN ACTIVATED SLUDGE, (IN JAPANESE),
Gifu Univ., (Japan). Faculty of Engineering.
T. Ogawa, E. Idaka, K. Hirabayashi, and Y. Takase.
Journal of the Society of Fiber Science and Technology, Japan, Vol 30, No 4, p 55-61, April, 1974. 7 fig, 4 tab, 10 ref.

Descriptors: *Waste water treatment, *Industrial wastes, *Textiles, *Dyes, Activated sludge, Biochemical oxygen demand, Biodegradation, *Biological treatment.
Identifiers: *Azo acid dyes, Bioflocculation.

Decontamination of waste water from dye industries by the activated sludge process is normally low. Influences of the composition of various culture media on the decreases of acid azo dyes and the growth curve of microbes were investigated in order to improve the decontamination properties. The culture media was prepared from meat extract, peptone, glucose, and mineral salts. The dyes were acid azo dyes which contained mono- or disulfonic acid groups. Bioflocculation and not biodegradation was found to be the major factor in the decontamination. When the BOD and dye concentration of the culture medium were equal to the concentrations in actual dye wastes, the decrease of the dyes was too low to decontaminate. However, when culture media had a concentration about 20 times the BOD of usual seage, there was a large decrease in the dye concentration (ranging from 60 to 97%) observed for acid dyes containing the monosulfonic acid group and a small decrease for the dye containing the disulfonic acid group. A lower digestion ratio of the BOD of the media resulted from the addition of the dye to the culture medium. Microbes could be adapted to the culture medium containing the dye by repeated inoculation, thus improving decontamination. (Murphy-FIRL)
W76-03074

THE DEVELOPMENT OF 'MITSUI KNIT FLOW' TYPES ACTIVATED SLUDGE AERATION TANK (MITSUI HENRYUSHIKI KASSEI ODEIHO BAKKISO NO KAIHATSU),
K. Ono.
Mitsui Zosen Giho, (Mitsui Shipbuilding Technical Review), Vol 85, p 33-41, January, 1974. 24 fig, 3 tab, 1 photo.

Descriptors: *Waste water treatment, *Industrial wastes, Textiles, *Activated sludge, Design, Biochemical oxygen demand, Mixing, Aeration, Tanks.
Identifiers: *Rayon manufacturing wastes, *Aeration tanks, Mitsui Knit Flow aeration tank.

Two types of aeration tanks are generally used for the activated sludge process of waste water treatment. These are the usual rectangular aeration tanks which provide economical utilization of space and easy plant expansion and the less compact circular aeration tank (such as 'Mitsui-Lubeck') which has superior capacity at high BOD or COD loading. Described is a third type of tank under development which is rectangular but has a high capacity, equal to the Lubeck type tank. This 'Mitsui Knit Flow' rectangular aeration tank is compared by structure, flow pattern of the mixed liquor in the tank, mixing characteristics, and test results of its waste water treatment to the two previous tanks. Using waste water froma rayon factory, the treatment capacity of the 'Mitsui Knit Flow' tank was better than the usual rectangular tank and almost equal to the circular type. (Murphy-FIRL)
W76-03075

WATER REUSE AND RECYCLE IN D(C)EDED BLEACHING,
J. A. Histed, and F. M. A. Nicolle.
Pulp and Paper Magazine of Canada, Vol 75, No 5, p 69-74, May, 1974. 4 fig, 4 tab, 10 ref.

Descriptors: *Waste water treatment, *Industrial wastes, Pulp and paper industry, *Pulp wastes, Water pollution control, Chemical oxygen demand, Biochemical oxygen demand, Dissolved solids, Color, *Water reuse, *Recycling.
Identifiers: Counter-current washing, Kraft bleaching effluents.

Countercurrent washing for pulp from the bleach stage of kraft mills is one proposed system of pollution abatement. Laboratory work on this method has indicated the effectiveness of this system. Effluents from the acidic and alkaline sewers of a bleachery using the DcEDED sequence to bleach can be reduced to 1685 U.S. gal/adbt by extensive chlorination filtrate recycling, and countercurrent washing. This method reduced the pollution load by 30% for COD, 40% for BOD5, 25% for dissolved solids, and 40% for color. The system may be used as a separate bleach plant effluent treatment or for bleach chemical recovery. (Murphy-FIRL)
W76-03076

POLLUTION CONTROLLED POLYSULFIDE RECOVERY PROCESS,
C. B. Fogman, H. W. Nelson, and U. Tsao.
Canadian Patent 948,376, Issued June 4, 1974. The Patent Office Record, Vol 102, No 23, p 7, June, 1974.

Descriptors: *Waste water treatment, *Industrial wastes, Pulp and paper industry, *Patents, *Pulp wastes, Sulfides, Hydrogen sulfide, Sulfur compounds.
Identifiers: *Polysulfide paper pulping wastes.

A patent was granted for a chemical recovery process for a polysulfide paper pulping system. Pulp washing, after polysulfide digestion, is performed in an essentially oxygen-free environment to minimize the oxidation of NaSH. Stripping and carbonation processes are performed by passing flue gas through a stripping tower and a carbonating tower. Na2CO3 is converted to NaHCO3 and is stripped to release H2S. This H2S is then converted to sulfur by the use of a liquid catalyst and the formed sulfur is then mixed and reacted with Na2S to form sodium polysulfide. The polysulfide liquor and any remaining white liquor are returned to the digestor. Desulfurized liquor from the stripping operation is subjected to an oxidizing-decomposing operation which oxidizes residual sulfides and decomposes residual NaHCO3. The treated liquor then has a pH of about 12.5, due to the addition of make-up NaOH and recycled and separtely oxidized white liquor. The resultant mixture is evaporated to about 50% dry solids concentration. Sulfur compounds in vent gases and condensates from mill process units are recovered with units to reduce air and water pollution. (Murphy-FIRL)
W76-03077

CLARIFICATION OF BOOK-MILL EFFLUENT BY ENZYME-ALUM,
Kimberly-Clark Corp., Neenah, Wis. Research and Engineering Dept.
Y. C. Wu.
Journal of the Environmental Engineering Division, Proceedings of ASCE, Vol 100, No EE3, p 541-548, June, 1974. 5 fig, 2 tab, 8 ref, 2 append.

Descriptors: *Waste water treatment, *Industrial wastes, Pulp and paper industry, *Pulp wastes, Laboratory tests, Suspended solids, Biochemical oxygen demand, Enzymes, Coagulation.
Identifiers: Starch, Book-mill effluents, Alum.

The use of an integrated enzyme-alum coagulating system for improving book-mill effluent clarification is considered. Laboratory tests were conducted to evaluate the following: actual performance of suspended solids and BOD5 removals; effects of pH, enzyme reaction time and sample age on the efficiency of process operation; optimum dose of saccharifying enzyme for the existing Kimberly Mill effluent treatment; and, potential savings in treatment cost. Samples from book-mill effluent from the plant at Kimberly, Wisconsin were filtered through a fine screen and coagulated. Analytical methods yielded several conclusions. It was proven that amylase enzymes (alpha and beta forms) can effectively reduce the dispersing power of the starch, resulting in a low chemical requirement for solids separation from book-mill effluent. If the pH of the mill effluent was in the range of 4.5 to 6.5 and the enzyme reaction time was at least 10 minutes, overall performance of an integrated enzyme-alum coagulation system was not affected by these parameters. Reduction of 5 to 10 percent BOD removal was caused primarily by the enzyme addition. The treatment cost of an integral enzyme coagulant system was between $16.2/million gal and $33.7/million gal. Actual cost is dependent upon concentration of suspended solids and starch. For a 10 mgd mill effluent treatment system, an annual saving is conservatively estimated at $4000 as compared to alum along. (Murphy-FIRL)
W76-03078

WATER POLLUTION CONTROL IN THE ITALIAN STRAW PAPER INDUSTRY,
Balfour-Italia, Rome (Italy).
R. M. Bradley.
Water Pollution Control, Vol 23, No 2, p 214-223, 1974. 6 fig, 11 tab, 1 ref.

Descriptors: *Waste water treatment, *Industrial wastes, Pulp and paper industry, Pilot plants, Activated sludge, Dewatering, Sludge treatment, Filters, *Pulp wastes.
Identifiers: Biofilters, *Straw paper industry, *Italy.

The straw industry in Italy faces increasing competition from wood-pulp products. An economic means of reducing the pollution load of the water discharged and treating the wastes is needed. Treatment trials at several pilot plants showed that the wastes from a straw paper mill which used almost no internal recirculation were treatable by a one-stage activated sludge system. However, no conclusive results could be drawn. Further studies are needed including: effects of different degrees of recirculation within paper mills; systems of fiber recovery; methods of sludge dewatering; improvements to the one-stage activated sludge process by controlling nutrient dosing; two-stage activated sludge processes to achieve higher quality effluents; and, biological filtration either along or in conjunction with activated sludge systems. (Murphy-FIRL)
W76-03079

HEAVY METAL-COMPLEXING AGENTS.
French Patent FR 2190-494, Issued March 8, 1974. French Patents Abstracts, Vol V, No 13, p D5, 1974.

Descriptors: *Waste water treatment, *Industrial wastes, *Heavy metals, *Patents, Mercury, Chromium, Lead, Cadmium, Copper, Iron.
Identifiers: Heavy metal complexing agents, Antimony.

A heavy metal-bonding agent is used for removing heavy metals (Hg, Pb, Cr, Cd, As, Cu, or Fe), from solutions or gases, such as industrial waste water. The bonding agent may be used as a powder or as shaped articles. It is prepared by reacting a -NH- and/or a -NH2-containing resin with CS2, used in atmospheres to incorporate at least 0.01 weight percent CS2 into the resin at 0-90 C. The reaction should take place for 10 minutes to 4 hours in a solvent and in the presence of a base. Optimally, the product should be reacted with a base at 10-50 C for 10 minutes or longer. (Murphy-FIRL)
W76-03080

RELIEVING WATER CYCLES BY THE USE OF INDIVIDUAL BACKFLUSH FILTERS (ENTLASTUNG DER WASSERKREISLARAUFE DURCH RUECKSPUELBARE EINZELFILTER),
B. Gockel.
Wochenblatt fuer Papierfabrikation, Vol 102, No 7, p 258-259, April, 1974. 1 fig.

Descriptors: Pulp and paper industry, *Filters, *Waste water treatment, Pumps, Recycling, *Industrial wastes, Water reuse, *Pulp wastes.

The uses of Ronningen-Petter filters with backflush and snap fit gives easy mounting in pulp and paper mill closed water cycle. Slightly polluted spray water from papermaking machines and Venta-Nip presses is cleaned by such filters, which are arranged in units of two or more for continuous operation in a closed water cycle. In addition, sealing water in vacuum pumps can be purified by means of Ronningen-Petter filters for being recycled in heat exchangers. (Takacs-FIRL)
W76-03081

PURIFICATION OF FOOD INDUSTRY-GENERATED WASTEWATERS. TECHNICAL AND SCIENTIFIC ASPECTS OF THE ALTERNATIVE: INDIVIDUAL OR COLLECTIVE TREATMENT (EPURATION DES EAUX RESIDUAIRES DES INDUSTRIES ALIMENTAIRES. ASPECTS TECHNIQUES ET SCIENTIFIQUES DE L'ALTERNATIVE: TRAITMENT INDIVIDUEL OU COLLECTIF),
L. Bolly.
Het Ingenieursblad, Vol 43, No 9, p 277-278, 1974.

Descriptors: *Food processing industry, *Waste water treatment, (Industrial wastes, Biochemical oxygen demand, Chemical oxygen demand, Biological treatment, Biodegradation, Activated sludge.
Identifiers: Municipal-industrial wastes, Chemical treatment.

General problems in the purification of waste waters generated by the food industry are surveyed. Food industry-generated waste waters have an average BOD level of 1,000 mg/liter, a suspended matter content of 150-1,500 mg/liter, and a COD/BOD ratio of 1.6 which indicates very good degradability. Such effluents are first freed

from mechanical impurities and sand, after which aeroflotation is usually applied. The decantation is considerably improved by the addition of lime, aluminum sulfate, ferrous or ferric sulfate, or ferric chloride. Biological treatment is possible in aerated lagoons that are sealed off to prevent groundwater contamination. Activated sludge treatment in basins or treatment on percolation bodies are the feasible methods suitable for biological purification. (Takacs-FIRL)
W76-03082

THE USE OF ALCOHOL DISTILLERY-GENERATED WASTE WATERS FOR IRRIGATION (ISPOL' ZOVANIYE STOKOV SPIRTOZAVODOV DLYA OROSHENIYA),
T. N. Khruslova.
Gidrotekhnika i Melioratsiya, Vol 194, No 3, p 94-97, 1974. 2 tab, 4 ref.

Descriptors: *Food processing industry, *Water reuse, *Recycling, *Waste disposal, Waste water treatment, Irrigation, Effluents.
Identifiers: Alcohol distilleries, Land treatment.

Experiences gained in experiments on the possible use of effluents generated by alcohol distilleries for irrigation of farmlands are presented. Effluents from alcohol distilleries can be used for irrigation after settling and pH adjustment to 6.5-7.5. The effluents should be mixed with fresh water in a ratio of at least 1:4 to limit the total mineral content to 18-20 g/liter. Distillery effluent should be used for irrigation at expenditures not higher than 500 cu m/ha. The accumulation of chlorine in the soil during irrigation may lead to a slight temporary increase in the chloride salt concentration. This is, however, easily neutralized by the fall rains. In addition, the use of sulfuric acid in the technological process eliminates this problem. (Takacs-FIRL)
W76-03083

EXPERIENCE WITH THE USE OF PROTOCOCCUS ALGAE FOR THE PURIFICATION OF WASTE WATERS GENERATED IN STARCH PRODUCTION (OPYT PRIMENENIYA PROTOKOKKOVYKH VODOROSLEY DLYA OCHISTKI STOCHNYKH VOD KRAKHMAL 'NOGO PROIZVODSTVA),
T. V. Gorbacheva, and A. A. Prokopenho.
Sakharnaya Promyshlennost', No 5, p 66-67, 1974.

Descriptors: *Food processing industry, *Waste disposal, *Chlorella, Effluents, Biochemical oxygen demand, Chemical oxygen demand, *Waste water treatment, Algae, Odor, Water purification.
Identifiers: Starch mill effluents.

The efficiency of Chlorella, a common algae, in the purification of effluents from a starch mill was studied in percolation fields. The experiment tasted over 50 considerable reduction in the BOD and COD levels were noted. The water became clear and odorless, and by the end of the 50-day experiment, the Chlorella population was reduced parallel to that of the BOD and COD contents. The efficiency of the treatment, expressed in terms of BOD reduction, ranged from 89.7 to 95.2%, corresponding to BOD reductions from 875-1,480 mg 02 per liter to 45-92.5 mg 02 per liter. Chlorella was less efficient in effluents with reduced pH values. (Takacs-FIRL)
W76-03084

ALTERNATIVE PROBLEM: COMMUNAL OR INDIVIDUAL PURIFICATION OF THE WASTE-WATERS GENERATED BY THE BIOLOGICAL INDUSTRIES IN THE LOUVAIN AREA (PROBLEMMSTELLING VAN HET ALTERNATIEF: GEMEENSCHAPPELIJKE OF INDIVIDUALE ZUIVERING VAN HET AFAVL-WATER VAN DE BIO-INDUSTRIE ROND LEUVEN),
L. R. Debleeckere.
Het Ingenieursblad, Vol 13, No 9, p 273-276, 1974.

Descriptors: *Food processing industry, *Waste water treatment, *Waste disposal, Effluents, Treatment facilities, Sewers, Biological treatment.
Identifiers: Louvain(France), Municipal-industrial wastes.

The alternative of communal or individual purification of waste waters generated in the food industry are discussed, based on examples from the United States and France. Conclusions are drawn for the food processing plants settled in the Louvain area. The examples from both the United States and France show clearly that food industries settled in or near communities tend to discharge their effluents into the municipal sewer systems after preliminary purification. Plants settled at a great distance from sewer systems purify their own waste waters, usually by a biological method, and often use the purified effluent for irrigation. The best solution for waste water purification for the particular food processing plants settled in the Louvain area was seen to be treatment in municipal waste water purification facilities. (Takacs-FIRL)
W76-03085

REMOVAL OF HEAVY METALS FROM LIQUID WASTE--CHELATE RESINS (HAISUICHU NO JUKINSOKU NO JOKYO--KIRETO JUSHI),
Y. Nanba.
Gijutsu to Kogai, (Technology and Public Nuisance), Vol 4, No 4, p 50-55, July 1974. 6 fig, 43 ref.

Descriptors: *Waste water treatment, *Industrial wastes, *Heavy metals, *Resins, Adsorption, Chelation.
Identifiers: *Chelating resins.

A method of removing heavy metals from liquid waste using chelate resins, and the properties of such resins are discussed. The mechanisms of neutralization coagulation settling of cadmium, zinc, chromium (+6), arsenic, lead, copper, and sulfides are detailed. Selective adsorption is a common property of various chelate resins, but it is affected by coexisting ions. Individual performance can be determined by testing equilibrium adsorption and the isothermal curve. Toxic metals from liquid wastes, as well as precious metals from plating waste water, can be recovered by this method. For these purposes, a resin packed tower is usually used. The pH affects adsorption. The optimum pH levels must be checked first, so that suspended substances are eliminated before adsorption. (Seigle-FIRL)
W76-03086

RESIDUE SEPARATION FROM WET ZINC OR COPPER EXTRACTION.
German Patent DS 2165-278. Issued June 6, 1974. German Patents Abstracts, Vol 5, No 24, p M2, July 19, 1974.

Descriptors: *Waste water treatment, *Industrial wastes, *Patents, Heavy metals, *Zinc, *Copper, Mining, *Separation techniques.

A patent was issued for a process of residue separation from wet zinc or copper extraction. Effluents from zinc and copper treatment plants are continuously separated and washed. The solutions, which contain residues, are added to a container holding a flocculant or a hydrophobicising agent in excess. The residue is continuously separated from the hydrogen produced by reaction between excess acid and fine metalic particles. The residue is then thickened to agglomerates in a settling zone, which are washed by counter-current techniques. After a series of washings, the residue is combined with an equal amount of washing fluid, transferred to the collecting vessel, thickened, and removed. (Kramer-FIRL)
W76-03087

TREATMENT OF WASTE METAL PROCESSING SOLUTION SPILLAGE,
I. E. Wittmann.
Canadian Patent 949,240. Issued June 11, 1974. The Patent Office Record, Vol 102, No 24, p 93-94, June 1974.

Descriptors: *Waste water treatment, *Industrial wastes, *Metals, Patents, Liquid wastes.
Identifiers: Metal finishing wastes, Cyanide.

A patent was grated for a process for treating spillage and waste solutions from a line of metal finishing processing solution tanks. The method prevents the formation of toxic hydrogen cyanide gas by passing waste solution receiving and conditioning liquid along a floor catch basin. The conditioning liquid waste is collected in an end-positioned sump from a lower end of the catch basin. Sufficient capacity allows for safe treatment of the probable worst condition regarding the spillage of acid and cyanide solution from the processing line. (Kramer-FIRL)
W76-03088

LATEX WASTE AND TREATMENT,
East Bay Municipal Utility District, Oakland, Calif.
R. T. Williams.
Journal of Paint Technology, Vol 56, No 594, p 46-50, July, 1974. 5 tab.

Descriptors: *Waste water treatment, *Industrial wastes, Municipal wastes, *Paints, Activated sludge, Lime, Suspended solids, Chemical oxygen demand.
Identifiers: Latex paint wastes, Combined municipal-industrial wastes, Alum.

Prior to the establishment of an industrial waste ordinance, the East Bay Municipal Utility District, in Oakland, California, performed a comprehensive investigation of industrial discharges. Results for latex paint washwater indicate that latex wastes are compatible with the municipal treatment plant. A combination of lime and alum treatment can remove 97.9 percent of the suspended solids and 70.1 percent of the chemical oxygen demand (COD). Activated sludge treatment removed 80.2 percent of the suspended solids and 66.5 percent of COD of one type of paint washwater. (Kramer-FIRL)
W76-03089

PROBLEMS OF WASTE WATER TREATMENT PLANT (PROBLEME EINER ZENTRAL-KLAERANLAGE),
W. Lutz.
Umweltschutz-Staedtereinigung, No 4, p 84-86, 1974. 2 fig, 3 tab.

Descriptors: *Waste water treatment, *Industrial wastes, Anaerobic digestion, Fermentation, Odor, Sludge, Dairy industry, Food processing industry, Bacteria, *Treatment facilities.
Identifiers: Combined municipal-industrial wastes.

The causes of anaerobic fermentation that occured in a two-stage biological waste water treatment plant which was receiving both municipal and industrial effluents in Austria during its start-up period were studied. The sludge indices in the first and second biological stages were determined to be 207 and 315 mg/liter. Odor nuisances, lactic fermentation, and proliferation of Sphaerotilus were observed. The aerobic process was found to be inhibited by dairy effluents that had not been either neutralized or disinfected prior to discharge into the sewage system. The pH value of this effluent fluctuated between 4.5 and 11.5 due to the alternate use of sodium hydroxide and nitric acid as cleansers. In addition, the effluent had very high lactic acid bateria counts. Another effluent from a sauerkraut canning factory was susceptible to the proliferation of such bacteria. After installation of an automatic pH correction unit and chlorination

at an expenditure of 15-20 g chlorine per cu m, the waste water treatment plant resumed normal operation. (Tackacs-FIRL)
W76-03090

PHYSICAL-CHEMICAL TREATMENT OF WASTE EFFLUENTS FROM CANNING OF LEAFY GREEN VEGETABLES,
Georgia Univ., Experiment. Div. of Food Science.
W. A. Bough.
Journal of Milk Food Technology, Vol 37, No 4, p 205-208, 1974. 6 tab, 18 ref.

Descriptors: *Waste water treatment, *Industrial wastes, *Food processing industry, Suspended solids, Turbidity, Polymers, Chemical oxygen demand, Flocculation, Activated carbon, Coagulation, Effluents.
Identifiers: *Physical-chemical treatment.

Physical-chemical methods of treatment are being increasingly applied to municipal and industrial wastes. Chemical methods of treatment applied to food processing wastes have most commonly employed inorganic salts such as lime, alum, or iron sulfate to coagulate suspended solids. The suspended solids in waste effluents from the canning of leafy green vegetables were effectively reduced by segregation and separate physical-chemical treatment of the unit wastes. Turbidity in the dunker washer effluent from spinach was reduced. Treatment consisted of adding 0.04 mg of an anionic polymer per liter of waste water at pH 4.0. The most concentrated effluent contained 11 percent of the total suspended solids load and 16 percent of the COD in only 1.3 percent of the waste water flow. A composite effluent from the canning of turnip greens and diced roots was treated with polymeric flocculating agents and activated carbon in a physical-chemical treatment system. The suspended solids concentration was reduced by 92 percent and the COD by 19 percent through flocculation and settling. (Kramer-FIRL)
W76-03091

WASTE WATER TREATMENT IN THE BEET-SUGAR INDUSTRY,
Raffinerie Tirlemontoise S.A., Tienen (Belgium). Research Dept.
L. Delvaux.
Sugar Technology Reviews, Vol 2, No 2 p 95-135, July, 1974. 10 fig, 2 tab, 233 ref.

Descriptors: *Waste water treatment, *Industrial wastes, *Food processing industry, *Sugar beets, Water reuse, Irrigation, Biological treatment, Reviews.

The increase of pollution in surface waters, the continuous increase in water needs, and the progressive strengthening of laws in highly industrialized countries are three central waste water problems of the sugar industry. The problems involved in settling, recycling and purification of the various water are reviewed as well as the quantities and the sugar-factory waters. An ideal scheme of water circuits which use no fresh water intake from the outside is examined, with discharge into the river of clean water of such a quality that no payment is required. The classical methods of treating waste waters, particularly flume and wash water, for purification before their discharge into a river or to enable their reuse are discussed. These are settling, irrigation and biological purification processes. Each sugar factory has its own problems in processing its waste waters; various solutions must be considered to choose the one appropriate to the circumstances of a given factory. (Kramer-FIRL)
W76-03092

TREATMENT OF WASTE WATERS FROM THE MEAT INDUSTRY,
M. C. Dart.
Process Biochemistry, Vol 9, No 5, p 11-14, June, 1974. 10 tab, 34 ref.

Descriptors: *Waste water treatment, *Industrial wastes, *Food processing industry, Pre-treatment(Water), Flotation, Anaerobic digestion, Biological treatment, Activated sludge, Filtration.
Identifiers: *Slaughterhouse wastes, Percolating filters.

Waste waters from the food industries are generally not directly toxic to aquatic organisms and fish. However, they do contain organic material in suspension, colloidal suspension, and solution, which can stimulate the growth of the naturally occuring microorganisms present in all surface waters, thereby causing oxygen depletion and deterioration of the water quality. Solid particles in the effluent can settle out on the bed of the stream or river causing a build-up of sludge deposits which rapidly become anaerobic. The volume of effluent and the pollution load to be expected from slaughterhouse and meat-packing plants is defined. Methods of treatment which have been used successfully are outlined. These include process modification, pre-treatment, dissolved air flotation, chemical treatment, anaerobic and aerobic biological treatment, percolating filters, and activated sludge methods. (Kramer-FIRL)
W76-03093

THE TREATMENT OF WOOL-SCOURING EFFLUENT: CENTRIFUGATION STUDIES,
New South Wales Univ., Kensington. (Australia). School of Textile Technology.
J. R. McCracken, and M. Chaikin.
Journal of the Textile Institute, Vol 65, No 6, p 314-324, 1974. 3 fig, 4 tab, 10 ref.

Descriptors: *Waste water treatment, *Industrial wastes, *Textiles, *Centrifugation.
Identifiers: *Wool scouring wastes, Grease.

The recovery of grease with a centrifuge from a wool-scouring liquor that has not been excessively agitated depends primarily on the composition of the disperse-phase particles. The composition of those particles not capable of being separated in a centrifuge depends on the quantity and density of detergent used in scouring. Excessive agitation of the scouring liquor greatly reduces recovery and should be avoided. Higher recoveries of wool grease in a centrifuge will be realized with raw wools containing relatively low proportions of oxidized matter in the wool-grease constituent. (Kramer-FIRL)
W76-03094

TREATMENT AND DISPOSAL OF EFFLUENT FROM THE WOOL TEXTILE INDUSTRY,
R. Harker, and R. Bruce.
Textile Journal, Vol 49, No 3, p 30, 32, 34, 36, March, 1974. 4 fig.

Descriptors: *Waste water treatment, *Industrial wastes, *Textiles, Centrifugation, Distillation, Water utilization, Dyes, Water consumption(Except Consumptive use), Waste water disposal.
Identifiers: *Wool scouring liquor, Grease, Vacuum filtration.

Investigations of several methods of effluent treatment from wool textiles have been conducted by Wira, the technical center for the United Kingdon wool textile industry. Topics included methods of treatment to produce effluents acceptable to river and local authorities and study of water usage. The two main treatment methods previously used were acid-cracking and centrifugation, which give grease recovery figures of 70% and 4-%, respectively. A small pilot plant was used to test vacuum filtration and distillation methods. It was concluded that the textile industry has a variety of liquors, and that some should be handled separately. In addition, new fibers, dyes, and methods of producing and finishing fabrics will lead to changes in the effluents produced. (Kramer-FIRL)
W76-03095

THE TREATMENT OF TEXTILE INDUSTRY GENERATED EFFLUENTS AND ECONOMY OF WATER CONSUMPTION (IL TRATTAMENTO DI EFFLUENTI TEXXILI E L'ECONOMIA NEI CONSUMI DI ACQUA). 21TINCTORIA, NO 2, P 61-64, FEBRUARY, 1974. 1 TAB.

Descriptors: *Waste water treatment, *Industrial wastes, *Textiles, Dyes, Filtration, Biological treatment, Water reuse, Flocculation, Activated sludge, Biochemical oxygen demand, Chemical oxygen demand.
Identifiers: Vacuum filtration, Closed water systems.

Reports by British Textile Research Institutes on textile industry generated waste waters are reviewed. Effluents generated by the textile industry contain fibrous and nonfibrous materials, fats, chemicals and dyes used in the production process. The collection and mixing of the different effluents in textile plants facilities further purfication, while primary settling in not necessary. Filtration and biological treatment are used for closed water cycles. Chemical flocculation with subsequent vacuum filtration, and biological treatment by the activated sludge method proved to be highly efficient. The latter method efficiencies of 80% and 67% in BOD and COD reduction, respectively. (Tackacs-FIRL)
W76-03096

TECHNIQUES FOR DECOLORING MILL WASTEWATER,
Weston (Roy F.), Inc., West Chester, Pa.
M. L. Woldman.
Textile Chemist and Colorist, Vol 6, No 8, p 29-32, August, 1974. 7 tab.

Descriptors: *Waste water treatment, *Industrial wastes, *Textiles, Dyes, Pre-treatment(Water), Biological treatment, Tertiary treatment, Activated carbon, *Color.
Identifiers: *Decolorization, Chemical treatment.

Techniques for the removal of dyes in effluents from textile mills are reviewed. On-site treatment methods considered include pre-treatment, primary treatment, biological treatment, chemical treatment, activated carbon and other tertiary treatment systems. In addition to these on-site treatment techniques, combined treatment with larger municipal systems is discussed. Data from existing treatment facilities are used to illustrate the color removal effectiveness of various techniques. (Kramer-FIRL)
W76-03097

UNIVERSITY OF CALIFORNIA PROCESS RECOVERS COPPER FROM LEACH LIQUOR.
Engineering and Mining Journal, Vol 175, No 8, p 30, August, 1974.

Descriptors: *Waste water treatment, *Industrial wastes, Copper, Mining, *Ion exchange, Electrodes, Separation techniques.
Identifiers: *Copper recovery.

A low cost process for copper recovery from liquor resulting from the leaching of copper ore and scrap metal has been developed. A cell was tested which consists of two compartments separated by an AMF ion exchange membrane. These compartments are filled with granular carbon which acts as electrodes, one charged negatively and the other positively charged. These are so charged that copper from a fresh solution is deposited on the carbon, while in the recycled solution compartment, copper is released into the solution and the resulting concentrate is fed into a electrowinning plant. After five days, the polarity is reversed. The electrical driving force can be accurately controlled, and the method recovers about 99% of the copper in solution. (Kramer-FIRL)
W76-03098

EFFECTS OF GRAZING ON INFILTRATION RATES IN WASTE WATER SPRAY FIELDS,
Agricultural Research Service, Morgantown, W. Va. Plant Science Div.
G. A. Pearson, G. A. Jung, R. E. Fowler, and D. M. Mitchell.
Soil Science Society of America Proceedings, Vol 39, No 5, p 954-957, September-October 1975. 1 fig, 2 tab, 26 ref.

Descriptors: *Compaction, *Food processing industry, *Irrigated land, *Infiltration rates, Waste water(Pollution), Spraying, Grasses, Waste water treatment, Soils, Grazing, Ponding, Rainfall, Saturated soils.
Identifiers: *Trampling, *Food processing, Irrigated pastures, Spray fields, Grass fields, Sandy loam, Sassafras sandy loam.

Many food processors use grass-covered sprayfields for treatment waste water. These fields are generally mowed one or more times each year. To eliminate mowing costs, such fields could be fenced and used as irrigated pastures. However, since the primary purpose of such fields is waste water treatment, adverse effects on infiltration must be avoided. particulary in areas with shallow soils that can not be manipulated for overland flow. A portion of a food-processor's wastewater treatment field was fenced and grazed for approximately 5 months during the summer and fall of 2 successive years. The soil series was Sassafras sandy loam and the grass species were 'Kentucky 31' tall fescue and orchardgrass (Dactylis glomerata, L.). The infiltration rate at saturation was measured frequently throughout the period of grazing. It was found that trampling reduced the infiltration rate from an initial value of 2-2.5 cm/hr to a final value of 0.3 cm/hr. If these fields had been grazed, it would have been necessary to use low wastewater application rates to avoid surface runoff and ponding in low spots. (Roberts-ISWS)
W76-03124

TERTIARY TREATMENT OF WASTEWATER USING OXIDATION PONDS,
Kentucky Water Resources Inst., Lexington.
R. A. Lauderdale, J. R. Moeller, and R. D. Hamilton.
Available from the National Technical Information Service, Springfield, Va 22161 as PB-248 713, $4.00 in paper copy, $2.25 in microfiche. Research Report No 89, December 1975. 40 p, 18 fig, 35 ref. OWRT A-051-KY(1). 14-01-0001-4017.

Descriptors: *Tertiary treatment, *Sewage lagoons, Effluents, Sewage bacteria, *Waste water treatent, *Oxidation lagoons, Sludge treatment, Activated sludge, Biochemical oxygen demand.
Identifiers: Waste water effluents.

The purpose was to determine the value of using lagoons as a supplemental process for treating the effluent from an activated sludge wastewater treatment plant. Only tentative conclusions can be suggested since the project was not carried to completion. It appears that lagoons will have only minimal effect on the amounts of total nitrogen and phosphate in the plant effluent, although conversion of a portion of the ammonia to nitrate can be expected. However, the concentration of ammonia was never lower than that required by EPA guidelines. Some reduction of soluble BOD appears to occur, perhaps through conversion to new cell material. Suspended solids concentrations can be expected to increase during periods of algae growth. The numbers of both fecal and total coliform bacteria decreased substantially during the detention period provided by the lagoon system. Although not confirmed, it was concluded that the most probable cause for the decrease was the intensity and duration of sunlight. The lagoon served very effectively as a buffer between the treatment plant and the receiving stream, providing a considerable measure of protection to the stream even during those periods during which the plant was by-passing a portion of the inflow. (Huffsey-Kentucky)
W76-03138

STUDY OF CROSSLINKED POLYMERS FOR DESALINATION,
Chemico Process Plants Co., El Monte, Calif. Envirogenics Systems.
For primary bibliographic entry see Field 3A.
W76-03147

DEVELOPMENT OF CTA HIGH FLUX LOW OPERATING PRESSURE R.O. MODULES,
Dow Chemical Co., Walnut Creek, Calif. Western Div. Research Labs.
For primary bibliographic entry see Field 3A.
W76-03149

FINAL REPORT--DETERMINING FEASIBILITY OF ALTERNATIVE APPROACHES OF OBTAINING SOLID-DRY BRINE EFFLUENT FROM DESALINATION PLANTS AT INLAND LOCATIONS,
Westinghouse Electric Corp., Lester, Pa.
For primary bibliographic entry see Field 3A.
W76-03152

FUTURE APPLICATIONS OF DESALTING PROCESSES FOR REDUCTION OF INDUSTRIAL WATER POLLUTION,
Stanford Research Inst., Menlo Park, Calif.
For primary bibliographic entry see Field 3A.
W76-03153

FINAL ANNUAL REPORT-VERTICAL TUBE EVAPORATOR MULTISTAGE FLASH TEST BED PLANT, FREEPORT, TEXAS, APRIL 1, 1972 TO MARCH 31, 1973.
Bechtel Corp., San Francisco, Calif.
For primary bibliographic entry see Field 3A.
W76-03157

ECONOMIC ASSESSMENT OF AN ACTIVITY ANALYSIS MODEL FOR WATER SUPPLY PLANNING,
Utah State Univ., Logan. Dept. of Civil and Environmental Engineering; and Utah Water Research Lab., Logan.
A. B. Bishop, B. C. Jensen, and R. Narayanan.
Water Resources Research, Vol 11, No 6, p 783-788, December 1975. 5 fig, 10 tab, 4 equ, 12 ref.

Descriptors: *Water supply, *Planning, *Water reuse, *Linear programming, Water resources development, Economics, Optimization, Water policy, Water quality, *Utah, Pricing, Water demand, Decision making, *Mathematical models, Systems analysis, *Treatment facilities, Waste water treatment, Water treatment.
Identifiers: Least cost solution, Capacity expansion, Salt Lake City(Utah).

A mathematical model for assessing the water supply alternatives with the reuse option is described, and its potential to yield results useful for economic analysis and policy making is explored. The results of the model for Salt Lake County, Utah, used as a case study area, are shown. The relative marginal values reflecting quality and accessibility of various sources can aid in planning future water resource development. The supply curves derived from the model are useful for pricing policies. The relative locational advantages of water and waste water treatment plants enter importantly into capacity expansion decisions. The least cost solution indicates the necessity of a facility to recycle waste water for municipal use under increased demand conditions.
W76-03163

WATER PURIFICATION MEMBRANES AND METHOD OF PREPARATION,
National Aeronautics and Space Administration, Moffett Field, Calif. Ames Research Center.
J. R. Hollahan, and T. Wydeven.
Available from NTIS, Springfield, Va 22161 as N75-13506, $3.50 in paper copy, $2.25 in microfiche. U.S. Patent Application Serial No. 313,389, 15 p, 5 fig; NASA Case No. ARC-10643-2, October 31, 1974.

Descriptors: *Patents, *Films, *Membranes, *Reverse osmosis, Thin films, Monomolecular films, Organic compounds, Fabrication, Desalination processes, Water quality control, Waste water treatment, Water purification.
Identifiers: Polymerization process, Patent application.

Allyl amine and chemically related compounds are polymerized as thin films in the presence of a plasma discharge. The monomer compound can be polymerized by itself or in the presence of an additive gas to promote polymerization and act as a carrier. The polymerized films thus produced show outstanding advantages when used as reverse osmosis membranes. The films achieve a maximum density during formation in the apparatus which results in little or no compaction when the film is used in reverse osmosis. The films are formed without pinholes in contrast with many prior films where small imperfections allow both solute and water to pass, and the film has a high adhesion on a variety of substrates and is easily formed in any desired configuration, so that one is not limited to flat surfaces to support the membrane. And finally while other membranes ordinarily must be kept in constant contact with pure water, this film can be stored dry under ordinary room conditions. (Sinha-OEIS)
W76-03171

GUNITING RESTORES A SEWER,
Clapsaddle-Garber, Marshalltown, Iowa.
For primary bibliographic entry see Field 8F.
W76-03193

INTERCEPTOR SEWER COST ANALYSIS,
Metropolitan Sanitary District of Greater Chicago, Ill. Sewer Design Section.
For primary bibliographic entry see Field 6C.
W76-03194

SEWER SYSTEMS IN THE COMMUNITIES AROUND LAKE SEVAN (SKHEMA KANALIZATSII NASELENNYKH MEST, RASPOLOZHENNYKH VOKRUG OZERA SEVAN),
S. S. Kotolikyan, and S. S. Zurgaryan.
Vodosnabzhenie i Sanitarnaya Tekhnika, No 6, p 14-15, 1975.

Descriptors: *Sewers, *Economics, Lakes, *Waste water treatment, *Biological treatment, *Treatment facilities, Water pollution control, Water quality control, Waste disposal.
Identifiers: *Lake Sevan(Armenian SSR), *USSR.

Plans for sewer systems for the communities around Lake Sevan, an important recreational area in the Armenian SSR, are presented. The option of full biological purification in five waste water treatment plants followed by discharging the purified effluents into Lake Sevan, was compared with biological treatment of all effluents in a common treatment plant with subsequent discharge into a river beyond the Lake Sevan water capture area. While the first choice would be more economical than the second one, the latter was chosen because of the added safety it offered regarding water pollution prevention in Lake Sevan. (Takacs-FIRL)
W76-03195

EXCAVATOR AND PUMPS CONQUER WATER TABLE.
For primary bibliographic entry see Field 8C.
W76-03196

SANTA CLAUS SEWAGE SYSTEM NEARS COMPLETION.
Water and Sewage Works, Vol 122, No 10, p 79, October, 1975.

Descriptors: *Sewerage, *Waste water treatment, *Sewage treatment, *Construction, Installation, Sewers, Municipal wastes, Industrial wastes, Clay pipes, Joints(Connections), Indiana, *Treatment facilities.

A sewerage system construction project in Santa Claus, Indiana, which cost $2 million was funded by a half grant, half loan from the Economic Development Administration (EDA). Sewage is processed in the $700,000 treatment plant at a rate of 500,000 gpd, and capacity can be increased to 800,000 gpd. The first phase for sewer line installation was completed in 1971. In December 1974, the Farmers Home Administration (FmHA) approved a loan of $1,360,000 and a grant of $250,000 to begin work on the final phase of the sewer system. This will serve primarily the domestic community as well as some light industry. All 118,000 feet of vitrified clay pipe have '0' ring compression joints; 18,885 ft of four-in diameter pipe, 2970 ft of six-in, 95,161 ft of eight-in, and 1036 ft of ten-in diameter pipe were supplied. Because much of the land in the area is hard rock formation, about 60% of the trenching had to be preceded by blasting with an air drill. Line and grade were monitored with a laser beam for laying the pipe. In the village area, 1850 new home sites are being built; each home lot carries a monthly $4 sewer charge to repay the FmHA loan. (Kramer-FIRL)
W76-03197

OXYGENATION EQUIPMENT--AERATORS AND PURE OXYGEN SYSTEMS,
Johnson (Bernard), Inc., Houston, Tex. Environmental Projects.
B. R. Tyer, and C. H. Hayes.
In: Chemical Engineering, Deskbook Issue, p 75-77, October 6, 1975. 1 fig, 11 ref.

Descriptors: *Oxygenation, *Aeration, Equipment, Installation, Economics, Rivers, Waste water treatment, Water quality, Costs, Treatment facilities.
Identifiers: Direct oxygenation.

Various types of aeration equipment (mechanical aerators, diffuser aeratio systems, brush aerators, venturi aerators) have been manufactured in the past few years. Onsite performances of several installed aerators used to oxygenate water were evaluated. The process design for direct oxygenation (using the UNOX system) as compared to air oxygenation, requires information on waste water quality and quantity, the required effluent quality, and relationships between the direct oxygen unit and other plant operations. In Batavia, New York, a demonstration project was performed to obtain comparative economic data on air and direct oxygenation systems. Results indicated a savings with direct oxygenation; costs for one mgd plant were projected as $0.12-$0.135 per lb of dissolved oxygen for direct oxygenation and $0.135-$0.165 for air, while those for a 100 mgd plant were $0.085-$0.095 for direct oxygenation and $0.105-$0.125 for air. In reaeration of the Ruhr river in Germany, however, air as the source of O2 was found to be more efficient. In another case, on the Great Miami River, Ohio, results of an instream aeration experiment with air and oxygen were reported. Direct oxygenation had the advantages of: a theoretical solubility advantage of 5:1 over air, the least disturbance to the water, the potential for supersaturating sidestreams with O2, and a cost of $0.084/lb of dissolved oxygen for direct oxygenation, as compared to $0.096/lb for surface aeration and $0.115/lb for air diffusion. (Kramer-FIRL)
W76-03198

LATEX PAINT WASTES--MUNICIPAL CHARGES AND TREATMENT,
East Bay Municipal Utility District, Oakland, Calif.
R. T. Williams.
In: Proceedings of the 29th Industrial Waste Conference, May 7, 8, and 9, 1974, Purdue University, Lafayette, Indiana, p 383-393. 13 tab, 9 ref.

Descriptors: *Pollution charges(Taxes), *Legislation, *Industrial wastes, *Sewers, *Municipal wastes, Construction costs, Operating costs, Waste water treatment, Chemical oxygen demand, Suspended solids, Water pollution control.
Identifiers: Municipal-industrial wastes, Latex paint industry, Sewer charges.

In view of federal regulations, the East Bay Municipal Utility District, Oakland, California, investigated the contribution of the latex paint manufacturing industry to the waste waters discharged to its municipal sewer system. The new regulations require municipal treatment agencies receiving construction grants for water pollution control facilities to recover from all industries their portion of the grant amount. The municipal agency receiving the grant must also adopt an equitable system of cost recovery reflecting the cost of treating the volume and quality parameters of the waste water. They also must define and enforce source control regulations on the industrial users. The strength characteristics and treatability of latex wash water were evaluated. Two treatment processes used at municipal plants were compared for efficiency, cost allocation, and revenue requirements. The rates charged the paint industry by the municipal agency for each process may be assessed or determined either on a surcharge basis or on a quality and quantity formula. Using a surcharge, the concentrations greater than 200 mg/liter of suspended solids and 400 mg/liter COD are computed, whereas the rates for a quality and quantity formula are assessed on the unit rates for volume and strength of the discharge. Latex is treatable either at the industrial facility of later by the municipal agency. The choice of treatment must be decided on a case-by-case basis, considering municipal effluent requirements, design criteria, and the proportion of industrial waste in the municipal plant effluent. (Kramer-FIRL)
W76-03199

RECYCLE OF LIQUOR FROM HEAT TREATMENT OF SLUDGE,
CH 2M Hill Inc., Corvallis, Oreg.
J. D. Boyle, and D. D. Gruenwald.
Journal Water Pollution Control Federation, Vol 47, No 10, p 2482-2489, October, 1975. 2 fig, 5 tab.

Descriptors: *Activated sludge, *Waste water treatment, *Treatment facilities, *Recycling, Heat treatment, Sewers, Costs, Biochemical oxygen demand, Suspended solids.

A newly expanded waste water treatment plant at Colorado Springs provides activated sludge treatment for wastes including high-strength recycle liquors from a sludge heat treatment system. The concept of the plant design and the operational experience for its first year of service are described. Process difficulties which have been eliminated were those associated with the illegal discharge to the city sewers of chlorinated hydrocarbon and organic phosphorus insecticides. A continuing operational problem is foam on the secondary clarifier, probably due to handling of scum skimmings in the heat treatment process. The total cost of expanding the treatment facility was $8,490,000, which included the heat treatment system, engineering, legal, and administrative work. 'Hidden costs', such as the aeration power increase caused by the heat treatment recycle liquor, were also analyzed. It was difficult to compare the costs of this system on a unit cost basis with the costs of other solids conditioning systems because of the effect of the recycle streams. The total costs of the heat treatment system, allowing for recycle effects, was found to be approximately $40 per dry ton of virgin solids. The heat treatment recycle liquor BOD contributed about 21% of the influent BOD load and about 30% of the suspended solids load. (Kramer-FIRL)
W76-03200

WHEN TO USE CONTINUOUS FILTRATION HARDWARE,
Envirotech Corp., Salt Lake City, Utah. EIMCO BSP Div.
R. C. Emmett, and C. E. Silverblatt.
Filtration and Separation, Vol 12, No 5, p 577-578, 580-581, September/October, 1975. 1 tab, 5 ref.

Descriptors: *Filtration, *Equipment, *Filters, *Economics, Flow *Waste water treatment.
Identifiers: Batch filtration, Continuous filtration.

An analysis was made of the many types of continuous filtration hardware available to the potential user. Choice of filter must be made on the basis of the types of slurries to be handled, factors considered in a continuous flowsheet, and certain economic limitations. The major properties of a feed slurry to be identified and evaluated are suspended solids concentration, particle size distribution, system composition, liquid viscosity, liquid volatility, degree of liquid saturation, temperature, special properties of solids or liquid, required materials of construction, and feed rate. Once these are determined, the true requirements of a filter station are found by defining the minimum tolerable performances and the peak (desired) performances of filtrate clarity, degree of washing and filter cake liquid content. Other facets of filtration operation to be considered include cake moisture, end use of solids, capital limitations, total process flowsheet, product value and in-process inventory, chemical conditioning, and pre-treatment of slurry. Almost any size continuous filter station requires a minimum investment of $20,000. Thus, if capital is severely limited and feed slurry rate is relatively low, a batch unit, rather than continuous filtration equipment may be chosen. If batch and/or continuous filtration equipment is feasible, the final decision should be governed by economics, including process reliability in the economic evaluation. A summary is provided in tabular form of some of the major factors to be considered in selecting equipment. Comments are provided relative to the applicability of continuous or batch pressure filtration equipment. (Kramer-FIRL)
W76-03201

A NOTE ON OPTIMAL TAXATION OF ENVIRONMENTAL SPILLOVERS,
Cornell Univ., Ithaca, N.Y.
For primary bibliographic entry see Field 5G.
W76-03202

FACTORS AFFECTING ADOPTION OF LAND TREATMENT OF MUNICIPAL WASTE WATER,
North Carolina State Univ., Raleigh. Dept. of Economics and Business.
G. A. Carlson, and C. E. Young.
Water Resources Research. Vol 11, No 5, p 616-620, October, 1975. 1 fig, 3 tab, 21 ref.

Descriptors: *Waste water treatment, *Municipal wastes, *Model studies, Economics, Statistical methods, Costs, Analytical techniques, *Land management.
Identifiers: Land application, Cost analysis.

Land treatment of municipal waste water has proven successful in the southern part of the United States. A model of local waste treatment

by land application is presented. A demand curve for land treatment was derived, using data collected from 125 cities, assuming a profit-maximizing framework. Outputs of a waste treatment facility were considered to be volume of waste water, degree of waste removal, and potentially marketable by-product. The dependent variable was adoption or non-adoption of land treatment and coefficients were estimated by non-linear regression. It was determined that the price of by-products (water), price of capital, required degree of treatment, and local construction cost contribute to an increase in adoption of land treatment. The volume of river flow, rainfall, and effluent volume have a negative effect on adoption, while land prices are not significant. The cost analysis suggests that municipal sanitary officials should try to determine what degree of treatment (BOD and nutrient removal) will be required by future state and federal regulations in order to better plan their treatment alternatives. (Kramer-FIRL)
W76-03203

DESIGN VALUE IN, WASTE OUT,
McKee-Berger-Mansueto, Inc., Washington, D.C.
A. J. Dell'Isola.
The American City and Country, Vol 90, No 10, p 51-54, October, 1975.

Descriptors: *Value engineering, *Waste water treatment, *Construction costs, *Treatment facilities, Analytical techniques, Equipment, Water quality control, Tertiary treatment.
Identifiers: Cost effectiveness.

The application of value engineering (VE) techniques to waste water treatment plant construction is described. The purpose of a VE or value analysis method is to detect and eliminate unnecessary costs. A multidisciplinary team of engineers, chemists, public officials and others work on defining basic versus secondary functions. These are then related to cost and 'worth'. Cost modelling involves ranking the systems, subsystems, and special equipment of a project from highest to lowest in terms of total cost per unit. The unit costs are then broken down into functional areas such as electrical, mechanical, structural. VE potential is determined and selection of project equipment is based on a cost/worth ratio. If this ratio is greater than two or three, poor value and high costs are indicated. Part of this analysis includes determining total or life-cycle costs. Value engineering was performed for a Plainville, Connecticut, proposed advanced waste water treatment plant. After a week-long workshop with consulting engineers and the Connecticut Department of Environmental Protection representatives, the town identified a potential first-cost savings of over $1.4 million, from the original $7.5 million cost estimate. Savings were found by consolidating several process operations under one roof, by improving effluent quality with fewer filter elements, and by using all-weather-rated equipment instead of structural protection for pre-treatment facilities. (Kramer-FIRL)
W76-03205

WATER MANAGEMENT IN ENGLAND: A REGIONAL MODEL,
North Carolina Univ. at Chapel Hill. Dept. of Environmental Sciences and Engineering.
For primary bibliographic entry see Field 6B.
W76-03207

EMERGENCY REPAIR OF CRACKED HOLDING TANK,
Illinois State Univ., Normal. Coll. of Applied Science and Technology.
For primary bibliographic entry see Field 8F.
W76-03209

MARSHES AND WETLANDS MAY PROVIDE SAFE COMMUNITY TERTIARY SEWAGE TREATMENT.
Compost Science, Vol 16, No 4, p 31, July-August, 1975.

Descriptors: *Waste water treatment, *Tertiary treatment, *Wetlands, *Marshes, Environmental effects, Biological treatment, Model studies, Waste water disposal, Water quality control.

The preliminary conclusion of a University of Michigan research project now in its third year is that marshes, bogs, swamps and other wetlands are able to provide high-quality tertiary sewage treatment. The project was designed to find out whether the natural processes in a 1,000 acre marsh near Houghton Lake in north central lower Michigan will be able to provide tertiary treatment of waste water without disturbing the ecological balance. The research has included a survey of pertinent scientific literature, the construction of a computer model of the marsh, and small, carefully controlled, on-site experiments. The model portrays the dynamic character of the marsh and accurately simulates the complex interactions among soil, water, wildlife, and climate. The model predicts that when millions of gallons of secondarily treated effluent are pumped into the marsh, the four-foot layer of peatland covering the area will absorb many of the dissolved nutrients in the water; only a small portion of the total will be utilized by vegetation. Wetlands bordering lakes and streams must not be used for treatment because of the risk that effluent would reach adjacent waters before being sufficiently purified. Each potential treatment site must be thoroughly studied to ensure that the wetland will be able to remain in an aesthetic and viable state, and the water quality will meet environmental standards. (Orr-FIRL)
W76-03210

STORM RUNOFF PURIFICATION IN COMBINED SEWER SYSTEMS IN TOWNS OF THE USA (OCHISTKA LIVNEVYKH VOD V SISTEME OBSHCHESPLAVNOY KANALIZATSII GORODOV SSHA),
N. A. Lukinykh.
Vodosnabzhenie i Sanitarnaya Tekhnika, No 7, 32-43, 1975. 3 fig, 3 tab.

Descriptors: *Storm runoff, *Combined sewers, *Treatment facilities, Biological treatment, Activated sludge, Aerobic conditions, Filtration, Lake Michigan, *Waste water treatment.
Identifiers: Microfiltration, Biosorption, Physico-chemical treatment.

Storm runoff purification in demonstration waste water treatment plants in Kenosha and Racine, USA are described. The Kenosha demonstration plant was dimensioned for an additional storm runoff of 78,500 cu m/day in rainy weather. The storm runoff is purified by a contact biosorption method using regenerated activated sludge of the principal waste water treatment plant in a quantity of 13,950 cu m at a contact time of 15 min. After the short-term contact and aeration, the storm runoff is sent to a radial settler from which the purified water is discharged into Lake Michigan; the activated sludge is sent to an aerobic stabilizing basin. The settling basin and the stabilizing basin are used for the stabilization of the excess activated sludge during dry weather, and for sludge storage during rainy weather. The storm runoff collected in the combined sewer system in Racine undergoes physico-chemical treatment by microfiltration and flotation tanks. Here, the storm runoff is treated with iron chloride (20-25 mg/liter) before microfiltration, and with cationic polyelectrolyte (1-4 mg/liter) after microfiltration. The water is disinfected with liquid chlorine at an expenditure of up to 20 mg/liter. One fourth of the water discharged from the microfilter is aerated to intensify the subsequent flotation process. The flotation residue is sent to the municipal biological waste water treatment plant. (Takacs-FIRL)
W76-03211

WIDE RANGE OF EQUIPMENT FOR SEWAGE DISPOSAL.
For primary bibliographic entry see Field 8C.
W76-03213

KILN DUST FROM CEMENT FACTORIES FOR VACUUM FILTER PROCESSING OF SEWAGE SLUDGE,
Pennsylvania State Univ., University Park. Dept. of Soil Chemistry.
D. E. Baker, S. Welch, W. Stout, and W. Doty.
Compost Science, Vol 16, No 4, p 28-30, July/August, 1975. 2 tab, 3 ref.

Descriptors: *Sludge treatment, *Waste disposal, Filtration, Sewage sludge, Lime, Flocculation, Analytical techniques, Economics, Energy, Sewage treatment, *Waste water treatment, Treatment facilities, *Filters.
Identifiers: *Vacuum filters, *Cement factory kiln dust.

A comparison was made between the use of kiln dust from cement factories and hydrated lime in the vacuum filter processing of sewage sludge within an operational sewage treatment plant. The conventional vacuum filter process of sludge uses hydrated lime and ferric chloride as flocculants. In this experiment, the coil filter was operated one day using the hydrated lime and the next day using kiln dust. Results were analyzed in terms of pH, dry matter, and chemical composition of raw sewage sludge; lime suspension produced from hydrated lime and kiln dust; filter cake produced by the vacuum filter process; and filtrate removed from the sludge in the process. It was found that kiln dust was equal to hydrated lime for processing the sludge and could be superior if used at a rate 1.3 times that normally used for lime. Because there is additional potassium and magnesium in the kiln dust, there is an advantage in its use where the filter cake and/or filtrate effluent are to be used as sources of nutrients for crop production. Economic advantages as well as energy conservation results from the use of kiln dust as a substitute for hydrated lime. (Kramer-FIRL)
W76-03214

ON THE OZONE TREATMENT AS PRE-TREATMENT OF ACTIVATED SLUDGE (KASSEI ODEN SHORI NO MAESHORI TO SHITENO OZON SHORI),
K. Aida, I. Somiya, and O. Kawara.
Preprint, Japan Society of Civil Engineers, Tokyo, p 667-668, October, 1975. 5 fig.

Descriptors: *Ozone, *Sewage treatment, *Chemical precipitation, Chemical oxygen demand, Biochemical oxygen demand, *Pre-treatment, Activated sludge, Biological treatment, *Waste water treatment.

Ozone treatment of sewage was investigated as a pre-treatment for the activated sludge method. Sewage was taken from the final precipitation pool of a sewage treatment plant in Kyoto, Japan, and its COD components were 184 mg/liter for the 3.8 to 0.45 micron size, and 57.1 mg/liter for the less than 0.45 micron size. A sample of 1.2 liter of liquid was treated in a batch type aeration tower with an ozonide oxygen flow rate of 2.0 liter/min. The ratio of COD values in the treated water and the initial water was then determined. Ozone concentration did not seem to have much affect upon the COD removal efficiency. COD removal proceeded quickly during the first five minutes of ozone treatment. The ratio obtained for total COD removal was 0.5 after the five minute ozone treatment. Eighty percent of the initial COD components sized greater than 0.45 microns could be removed in five minutes ozone treatment. During the ozone treatment, the BOD5 value did not increase, but the ratio between BOD5 and COD values increased. This suggests that the use of ozone as a pre-treatment method for activated sludge would increase the effectiveness of the

biological decomposition process in the waste water. (Katayama,FIRL)
W76-03215

PERMUTIT SA ENTERS SEWAGE TREATMENT FIELD.
South African Chemical Processing, Vol 10, No 4, p 27, June/July, 1975. 1 fig.

Descriptors: *Sewage treatment, *Treatment facilities, *Biological treatment, *Aeration, *Sludge treatment, Nitrification, Sedimentation, Waste water treatment, Settling basins, Africa.
Identifiers: *Contact Stabilization(CS), *Extended aeration, South Africa.

The Permutit company, South Africa, has expanded its primarily industrial waste water treatment activities to include sewage treatment. Initially, pre-engineered units will be used to treat up to 15,000 population equivalents. Either the Extended Aeration (EA) or the Contact Stabilization (CS) process will be used. The design criteria for sewage treatment facilities were sewage flow, composition (particularly BOD loading) and turn down ratio required. The EA process was found to be economical for small plants, while the CS sheme has advantages for larger size plants. The Contact Stabilization process was detailed. It consists of two aeration steps, separated by a settlement stage. In the first aeration stage raw sewage and stabilized activated sludge are mixed and aerated. After 0.25 to 1.50 hours, sludge and liquor are separated, and sludge is returned to a second aeration step for 1.5 to 5.0 hours. Because the total aeration time for EA is about 24 hours, the CS process has the time advantage. The CS process achieves a high degree of nitrification in spite of this short aeration time and has much better sludge settlement rates. The reason for this is that there are about four times the bacteria in the contact aeration zone than in other treatment processes. As a result, to up-rate a conventional plant to a CS plant, the only necessary change was found to be the extention of the settling tank area. (Kramer-FIRL)
W76-03216

SUPERNATANT AND FILTRATE TREATMENT,
Jones and Henry Engineers, Ltd., Toledo, Ohio.
F. F. Sampayo.
Pollution Engineering, Vol 7, No 9, p 36-38, September, 1975. 1 fig, 1 tab.

Descriptors: *Waste water treatment, *Biological treatment, *Effluents, Ammonia, Nitrification, Hydrogen ion concentration, Lime, Biochemical oxygen demand, Anaerobic digestion, Filtration, Filters, Suspended solids.
Identifiers: *Anaerobic digester supernatant, *Vacuum filter filtrate.

Production of high quality effluents, such as those planned for an improved waste water treatment plant in Pontiac, Michigan, will necessitate reconsideration of conventional processing methods for anaerobic digester supernatant and vacuum filter filtrate. These wastes shock load biological treatment processes by increasing BOD, suspended solids, and ammonia concentrations. A new process suggested for the Pontiac plant mixes the two waste streams, discharging them by gravity and heating them with available hot water from the incinerator exhaust gas scrubbing system. The pH is adjusted to 11 or 12 with lime and the high pH wastes are discharged to an ammonia stripping tank. This process is expected to reduce ammonia-nitrate concentrations in the recycle streams to 100 mg/liter or less, as well as removing substantial amounts of BOD and suspended solids. Ammonia discharge to the atmosphere will also be largely avoided. The process uses both chemicals sand power with efficiency. (Beale-FIRL)
W76-03218

HYDROGEN PEROXIDE SOLVES HYDROGEN SULFIDE PROBLEM,
Hampton Roads Sanitation District, Norfolk, Va.
S. R. Lindstrom.
Pollution Engineering, Vol 7, No 10, p 40-41, October, 1975. 1 fig, 1 tab.

Descriptors: *Odor, *Hydrogen sulfide, Waste water treatment, *Sewage treatment, Virginia, Anaerobic conditions, Treatment facilities, Environmental effects, Costs, Oxidation, *Waste water treatment.
Identifiers: *Hydrogen peroxide.

The Hampton Roads Sanitation District, Virginia, has found that hydrogen peroxide application was successful in eliminating noxious odors caused by hydrogen sulfide in a waste water treatment plant. Tests were conducted in two systems: the Chesapeake-Elizabeth System in Virginia Beach and the James River System in Newport News. Both systems were large, and sewage is pumped long distances through pressure lines for treatment. Anaerobic conditions result from a long sewage retention time, and high (7 to 8 ppm) levels of hydrogen sulfide are formed. Additionally, the buildup of H2S in working areas is a danger, and complaints of odors have been made by residents and people travelling on adjacent highways. Tests with hydrogen peroxide were initiated in April 1973 and a year later, as a result of successful odor removal, the two hydrogen peroxide injection systems were installed. Injection points were far enough upstream that hydrogen peroxide had at least ten minutes to react with the H2S before the sewage came out into the air at the head of the plant. At first a ratio of 2.5:1 was thought necessary (H2O2:H2S) to assure oxidation of all the hydrogen sulfide. At the James River system this was followed, with an injection ratio of 17.5 ppm. The Chesapeake-Elizabeth system experimented and found that 15.3 ppm would also effectively destroy all the hydrogen sulfide, with a lower cost. Installation involved a simple passivated aluminum storage tank, two variable speed pumps, and necessary piping; there were no real maintenance costs. Thus, the only expense was the cost of hydrogen peroxide. The daily cost at both plants was $1,325, higher than costs of chlorine, but without chlorine handling or residual hazards. (Kramer-FIRL)
W76-03219

ON THE NITROGEN BEHAVIOR IN THE PROCESS OF OZONE TREATMENT (OZON SHORI NI OKERU CHISSO NO KYODO NI TSUITE),
K. Aida, I. Somiya, and H. Yamada.
Preprint, Japan Society of Civil Engineers, Tokyo, p 524-525, October, 1975. 25 fig.

Descriptors: *Nitrogen, *Ozone, *Sewage treatment, *Waste water treatment, Proteins, Nitrates, Amino acids, Hydrogen ion concentration, Ammonium compounds, Recycling.

The transformation of nitrogen compounds of amino acids and protein in sewage upon ozone treatment was studied using glycine, glutamic acid, and albumin in cow serum. The concentrations of nitrate ion, ammonium ion, amino acids, and protein in solution were compared to the ozone treatment time, and the effect of the initial solution pH on these nitrogen transformations was also studied. In the case of glycine, the initial concentration was adjusted so that the initial nitrogen in the solution was 9.3 mg/liter; the solution was then treated with ozone. After 40 minutes of ozone treatment, the nitrogen composition in the treated solution was 50% nitrate, 45% ammonium, and 5% amino acid. These changes were not greatly affected by the initial solution pH, and the nitrate and ammonium productions were increased with an increase in ozone treatment time. The nitrogen transformation for glutamic acid was similar to the result obtained with glycine, and was unaffected by the solution pH. The albumin could be ozonized from a solution with a pH between 6.39 and 9.82; however, the amount of unrecovered nitrogen increased with the increased ozone treatment time. The recovery of the initial nitrogen (6.5 mg/liter) after 40 minutes of ozone treatment was 1.8 mg/liter and 50% of this was ammonium with the rest being protein. Nitrate was produced during the ozone treatment of albumin, but could not be detected after 40 minutes of treatment. (Katayama-FIRL)
W76-03221

OZONE CONTACT SYSTEM FITS INTO TIGHT GRIT CHAMBER,
New York City Dept. of Public Works. Bureau of Water Pollution Control.
M. Baratt, and A. Somerville.
Pollution Engineering, Vol 7, No 10, p 38, October, 1975.

Descriptors: *Ozone, *Odor, *Sewage treatment, *Treatment facilities, New York, Construction materials, Hydrogen sulfide, Methane, Air pollution, *Waste water treatment.

The Manhattan Grit Chamber in New York City treats all sewage and storm drainage for 3253 acres of upper east side Manhattan. Pollution control facilities are being continually expanded and modernized. Methane and hydrogen-sulfide based odors had caused a serious problem and an ozone contact chamber was designed to oxidize the air and relieve the condition. While ozone contact chambers are ordinarily built with stainless steel supports and concrete walls, there was not property available to construct this type of a facility contiguous to the chamber. It was therefore decided to locate the contact chamber within the building. A combination of fiberglass reinforced plastic structurals supporting rigid baffles of polyvinyl chloride, reinforced with embedded steel wire, was constructed. These baffles, unaffected by the ozonated air, contributed to a weight savings. The ozone contact chamber measured 21 by 96 ft. An ozone generator was operated 24 hr/day, 7 days per week, producing ozone in a one percent concentration at a rate of 17.6 lb/day. Tube axial fans moved the odor-filled air through stainless steel ductwork up to the ozone chamber maze where it mixed with ozone. Minute organic particles were rendered inert and methane and hydrogen sulfide-based odors were eliminated. (Kramer-FIRL)
W76-03223

COLESHILL AWT WORKS--'A VERY DE-LUXE PLANT'.
Surveyor, Vol 146, No 4348, p 9, October 10, 1975.

Descriptors: *Tertiary treatment, *Pilot plants, *Waste water treatment, *Sewage treatment, Dewatering, *Treatment facilities, Laboratory tests, Biological treatment, Flocculation, Lime, Settling basins.
Identifiers: Physico-chemical treatment, Advanced waste water treatment plant, Chemical treatment, Great Britain.

The Advanced Waste Water Treatment plant, an experimental works, has been built under NATO auspices at Coleshill, near Birmingham, Great Britain. The Coleshill works was built as a pilot plant and the goal of the project was to allow new techniques to be assessed under near full-scale conditions. The installation provides for two treatment streams, each with an average daily flow of 454 cu m. One stream is completely domestic, while the other sewer contains some industrial waste water. The fixed Coleshill installation will include inlet works, a services gantry, a reagent preparation plant, sludge dewatering equipment, monitoring, instrumentation, and a laboratory workshop, substation, and office buildings. Initially physical-chemical treatment will be examined; later other processes, particularly combinations of physical-chemical and biological treatment will be evaluated. The two process

streams may be operated independently so that performance of the two processes may be compared simultaneously. A mobile modular concept will be used for the facility, so that operating conditions for individual units can be altered without changing the whole process, and units needing repair or modification can be removed and substituted. Work so far has concentrated on the use of chemically-aided settlement using available mixing, flocculation, and settling tanks. Further work involved the addition of lime together with ferric sulfate to one stream, with the other as a primary sedimentation control. The addition of chemicals has been found to significantly reduce the phosphate concentration. (Kramer-FIRL)
W76-03224

GREASE PROBLEMS IN MUNICIPAL WASTE-WATER TREATMENT SYSTEMS,
MCA Engineering Corp., Baltimore, Md. Environmental Div.
S. K. Banerji, C. M. Robson, and B. S. Hyatt, Jr.
In: Proceedings of the 29th Industrial Waste Conference, May 7-9, 1974. Purdue University, Lafayette, Indiana, p 768-781. 1 fig, 7 tab, 27 ref.

Descriptors: *Oil wastes, *Municipal wastes, *Waste water treatment, Analytical techniques, Industrial wastes, Waste disposal, Sewers, Economics, *Pollutant identification.
Identifiers: *Grease, Municipal-industrial wastes.

Problems of the discharge of industrial wastes with high grease, fat, or oil contents into municipal sewer systems were presented. Methods of analysis for grease, fats, and oils were reviewed, and available technology for removing this material from waste water and subsequent disposal methods were discussed. Two case histories were conducted. One compared pre-treatment of industrial waste water containing grease at the source versus providing grease removal facilities at a municipal waste water treatment plant. The second study described the economic analysis of two alternate pre-treatment systems for removal of grease from a poultry processing waste water. It was concluded that the present level of 100 mg/liter hexane or ether soluble grease and oil as a common limitation for municipal sewer ordinances should be re-evaluated. Ay future grease or oil removal data or criteria should state the analytical procedure used. For example, if a solvent extraction method is used, the solvent should be identified. Additionally, when industrial wastes are treated at the source for grease or oil removal, the municipal sewer and waste water treatment plant operations will be reduced. (Kramer-FIRL)
W76-03225

PRIMARY-WASTE-TREATMENT METHODS,
Environtech Corp., Salt Lake City, Utah.
L. D. Lash, and E. G. Kominek.
In: Chemical Engineering, Deskbook Issue, p 49-61, October 6, 1975. 14 fig, 4 tab, 12 ref.

Descriptors: *Sewage treatment, *Waste water treatment, *Industrial wastes, *Municipal wastes, Treatment facilities, Chemical precipitation, Oil wastes, Separation techniques, Filtration, Coagulation, Costs, Centrifugation, Suspended solids.

Methods of primary treatment of waste water are dependent upon whether the effluent will be subjected to further treatment or whether it will be discharged to a municipal sewer system, a river, or a lake where its effluent quality must meet federal, state, and/or local standards. Fourteen types of primary treatment are detailed. These are: screening, centrifugal separation, neutralization, aeration, chemical oxidation, chemical reduction, precipitation, coagulation, gravity separation, induced-air flotation, dissolved-air flotation, media filtration, diatomite filtration, and ultrafiltration. Several of these treatment methods will reduce a given pollution load to within required limits, when used alone or in some combination. The decision to discharge wastes to a municipal sewer system for partial or complete treatment must be based on a comparison of capital and operating costs and sewer charges. The decision to install a treatment plant and its possible layout were discussed. Choice of waste treatment is dependent upon waste composition, including: acids and alkalis; suspended solids; fats, oils and greases; and dissolved solids, both mineral and organic. A selection among each of the fourteen primary waste treatment methods for removal of dissolved solids, suspended solids, and oil matter from waste waters must be based on physical and chemical properties of the stream. Layout of a waste treatment facility must be determined by the worst possible combination of flow and pollutant-load variation. (Kramer-FIRL)
W76-03226

EQUIPMENT FOR DEWATERING WASTE STREAMS,
Dorr-Oliver, Inc., Stamford, Conn. Environmental Technology.
R. R. Evans, and R. S. Millward.
In: Chemical Engineering, Deskbook Issue, p 83-87, October 6, 1975. 4 fig, 1 tab, 4 ref.

Descriptors: *Dewatering, *Waste water treatment, *Waste treatment, *Sludge treatment, *Oil wastes, *Chemical industry, Activated sludge, Equipment, Centrifugation, Separation techniques, Waste disposal.
Identifiers: Sludge volume index(SVI), Sludge handling.

Various types of dewatering equipment are available to achieve desired concentrations of wastes for minimum costs of subsequent sludge handling. In selecting a particular dewatering technique, the specific process waste stream must be evaluated. The three general categories of waste sludges are primary solids, chemical precipitates, and biological solids. In petroleum refining, primary solids include oil-coated corrosion products, carbon, catalyst fines, sand, and silt. In the pulp and paper industry, sludge solids contain fibers and insoluble constituents, while in organic chemicals industry, primary solids may be unwanted byproducts, and used processing aids. The most common chemical precipitates generated during liquid waste treatment include metals. Biological sludges vary widely in characteristics, and thus require many types of dewatering equipment. The thickening characteristic of sludge, or sludge-volume index (SVI), from the activated sludge process may vary from 50 to 350. Evaluation of the alternatives for dewatering involves matching of process requirements and separation techniques. Various gravity thickeners, centrifuges, vacuum filters, and filter presses were compared. It was emphasized that engineers must develop their objectives (such as product parameters of solids in the liquid phase, and liquids in the solid phase) and define feed conditions (including solids concentration, density, and particle size), and base equipment selection of these data. (Kramer-FIRL)
W76-03227

NITRIFICATION OF A HIGH AMMONIA CONTENT SLUDGE SUPERNATANT BY USE OF ROTATING DISCS,
Metropolitan Sanitary District of Greater Chicago, Ill. Dept. of Research and Development.
C. Lue-Hing, A. W. Obayashi, D. R. Zenz, B. Washington, and B. M. Sawyer.
In: Proceedings of the 29th Industrial Waste Conference, May 7-9, 1974, Part 1, Lafayette, Indiana, Purdue University, p 245-254. 5 fig, 7 tab, 9 ref.

Descriptors: *Nitrification, *Ammonia, *Sludge, Biochemical oxygen demand, Chemical oxygen demand, *Waste water treatment, Nitrates, Nitrites, Nitrogen, Alkalinity, Microorganisms, Suspended solids, Chemical analysis, Effluents, Lagoons, Anaerobic digestion, Strip mines, Monitoring.
Identifiers: *Sludge lagoon supernatant, *Rotating disc system.

When anaerobically digested sludge is stored in lagoons, awaiting use as fertilizer for strip-mined lands, a substantial layer of sludge lagoon supernatant (SLS) is formed. SLS has a relatively high concentration of NH3-N, making it undesirable for use on the land. The feasibility of nitrifying SLS using a rotating disc system (RDS) is discussed. The rotating discs provide an area for the attachment and growth of microorganisms and a means of aeration of the sludge. The objectives of the study were to determine whether a sufficient population of nitrifiers could be established on the discs to oxidize the ammonia waste water in a reasonable amount of time and to evaluate the ability of the RDS to act as an aeration-reaeration system. The total surface area of the discs in the RDS was 250 sq ft, and they rotated at a speed of 3 rpm. The temperature was kept at a constant 22 C. Since nitrification causes a destruction of alkalinity, pH had to be controlled and monitored. The RDS was monitored and sampled once a day, seven days a week. Various chemical analyses were run on influent and effluent samples, in order to monitor pH, biochemical oxygen demand, chemical oxygen demand, suspended and total solids, and the concentrations of ammonia, nitrates, nitrites, and nitrogen. Results showed that NH3-N, at an overall loading of 25 lbs/1,000 cu ft/day was reduced by 99% by the RDS. (Pinto-FIRL)
W76-03228

THE EFFECT OF CIRCULATION BAFFLES ON THE OXYGENATING EFFECT OF AERATORS OPERATING IN HORIZONTAL POSITION (WPLYW PRZEGRODY CYRKULACYJNEJ NA EFEKTY NATLENIANIA URZADZEN PRACUJACYCH NA WALE W POZYCJI POSIOMEJ),
For primary bibliographic entry see Field 5F.
W76-03229

WASTE WATER TREATING OPERATION USING MICROBIAL MEMBRANE (I). ANALYSIS OF RESISTANCE TO MOVEMENT WITHIN LIQUID PHASE,
For primary bibliographic entry see Field 5A.
W76-03230

METHODOLOGY FOR APPLICATION OF ADENOSINE TRIPHOSPHATE DETERMINATION IN WASTEWATER TREATMENT,
Biospherics Inc., Rockville, Md.
G. V. Levin, J. R. Schrot, and W. C. Hess.
Environmental Science and Technology, Vol 9, No 10, p 961-965, October, 1975. 6 fig, 2 tab, 14 ref.

Descriptors: *Waste water treatment, *Sewage, *Activated sludge, Analytical techniques, Operation, Monitoring, Treatment facilities, Pollutant identification.
Identifiers: Adenosine triphosphate(ATP).

Because the operation of an activated sludge waste water treatment plant is based on the metabolic activity of the viable organisms present in the mixed liquor, it is necessary to have a rapid and accurate method for determining the viable biomass. A method based on the bioluminescent assay of microbial adenosine triphosphate (ATP) is presented for this purpose. Boiling TRIS buffer was selected for the extraction of ATP from sludge and mixed liquor because of its simplicity of procedure and reproducibility of results. The determination of ATP, dissolved oxygen uptake rate, tyrosine, total microscopic cell count, and turbidity in pure cultures indicated the sensitivity of the method and its applicability to activated sludge process monitoring and control. ATP measurements were then performed in a 20 mgd activated sludge sewage treatment plant. ATP analysis was used to control the mixed liquor biomass

through the regulation of return sludge. A test period of one month demonstrated that good plant performance was achieved by using the ATP monitoring technique, and that there is a close relationship between ATP content and the metabolic activity of the sludge. The process should improve the quality and stability of the effluent as well as reduce operating costs and effectively increase plant capacity by minimizing the return sludge pumping. (Orr-FIRL)
W76-03232

AUTOMATED METHODS FOR ASSESSING WATER QUALITY COME OF AGE,
Technicon Industrial Systems, Tarrytown, N.Y.
For primary bibliographic entry see Field 5A.
W76-03233

OXYGEN TRANSFER AT HIGH SOLIDS CONCENTRATIONS,
Minnesota Marine Advisory Service, Duluth.
D. R. Baker, R. C. Loehr, and A. C. Anthonisen.
Journal of the Environmental Engineering Division Proceedings of ASCE, Vol 101, No EE5, p 759-774, October, 1975. 13 fig, 1 tab, 8 ref.

Descriptors: *Aeration, *Design criteria, *Oxygen, *Waste water treatment, Biological treatment, Oxygen demand, Nitrification, Municipal wastes, Industrial wastes, Temperature, Viscosity.
Identifiers: *Oxygen transfer, Mixed liquors, Oxygen uptake rates.

The design of aeration systems for agricultural, industrial, and municipal wastes requires the knowledge of the capability of an aeration device to transfer oxygen to the waste water. Because factors affecting the capability are related to the characteristics of the waste water being aerated, this investigation was conducted to determine how the characteristics of the mixed liquor affected the oxygen transfer capacity of the aerator. Variations in oxygen demand that occurred under operating conditions were also evaluated. This particular study involved oxygen transfer and uptake relationships of waste waters at the solids concentrations found in animal waste treatment facilities. After 13 months of study, the changes in solids concentration and temperature and their effects on oxygen uptake and transfer rate in the mixed liquor were evaluated. Relationships were also found between viscosity, total solids, and alpha. It was found that oxygen uptake rates were not influenced by temperature or total solids concentration variations. Alpha was seen to decrease as the solids concentration increased above 2% and as viscosity increased. Alpha was not affected by temperature variations. The viscosity of the mixed liquor increased with an increase in solids concentration, and the effect of solids on oxygen transfer may be related to viscosity. The appropriate parameters were found for design of an aeration system treating these particular wastes. For cases when solids concentration is greater, a larger dissolved oxygen residual is needed, or a higher nitrification degree is required, the rotor should be designed for a greater oxygen transfer capacity. (Kramer-FIRL)
W76-03236

CHEMICAL TREATMENT FOR PHOSPHATE CONTROL,
California Univ., Berkeley. Div. of Hydraulic and Sanitary Engineering.
J. N. DeBoice, and J. F. Thomas.
Journal Water Pollution Control Federation, Vol 47, No 9, p 2246-2255, September, 1975. 4 fig, 4 tab, 11 ref.

Descriptors: *Phosphate, *Chemical precipitation, *Computer programs, *Model studies, Calcium, Carbon dioxide, *Waste water treeatment.
Identifiers: Phosphate precipitation, Calcium phosphate, *Chemical treatment.

A computer program has been developed that is useful for determining the general effects of waste water treatment process modifications and variations on calcium phosphate precipitation and for comparing the efficiencies of alternative treatment processes. The program is based on an equilibrium model which considers precipitation of Ca3(PO4)2 and CaCO3 with pIAP values of 25.46 and 7.13, respectively. Pilot plant results were in agreement with computer results. The chemical process found to have the greatest effect on phosphate precipitation was the exchange of carbon dioxide with a gas phase. More than 90% of the phosphate in a typical waste water with an initial pH of 7.1, total calcium of 60 mg/liter as Ca, and total orthophosphate of 9.3 mg/liter as P could be precipitated by equilibrating the solution with an atmosphere containing 0.033% CO2. Additionally, higher final phosphate concentrations are to be found in processes with high levels of dissolved CO2 than those with low levels of dissolved CO2. It was recommended that the techniques and methodologies developed to solve this problem should be used for other areas. Similar possible studies include the precipitation of aluminum and iron phosphates for phosphate removal; precipitation of calcium carbonate in lime-softening processes; and precipitation of carbonates, sulfates, and silicates in recirculating cooling systems, heat exchangers, or ammonia-stripping towers. (Kramer-FIRL)
W76-03242

MUNICIPAL WASTEWATER PLANT PROBLEMS WITH CYANIDE EFFLUENT REGULATIONS,
Metropolitan Sanitary District of Greater Chicago, Ill. Industrial Waste Div.
D. T. Lordi, C. Lue-Hing, and E. Knight.
In: Proceedings of the 29th Industrial Waste Conference, May 7, 8, and 9, 1974. Lafayette, Indiana, Purdue University, p 338-347. 5 fig, 5 tab, 6 ref.

Descriptors: *Toxicity, *Effluents, *Waste discharge, *Industrial wastes, *Municipal wastes, *Pollutant identification, *Sewage treatment, *Waste water treatment, Analytical techniques, Legislation, State jurisdiction.
Identifiers: *Cyanides.

The Illinois Pollution Control Board (IPCB) cyanide standard of 0.025 mg/liter for discharge to waterways and to municipal sewer systems was evaluated. Studies were performed on the determination of cyanide levels present in treatment plant effluents and the raw sewages to each of the three major Chicago-area treatment plants. Other sources of cyanide not attributable to industrial cyanide wastes were also measured. The possible identification of effluent cyanide as simple and/or complex was then made. It was found that effluents from some of the smaller treatment plants having no known significant industrial waste load showed daily values exceeding the 0.025 mg/liter limit (including analytical variations). Between 92 and 100% of the time, these plant effluent cyanide levels were below 0.050 mg/liter, and averaged between 0.010 mg/liter and 0.024 mg/liter. A program has been initiated to determine whether the form of cyanide occurring in raw sewages and final effluents is simple or complex. It appears so far that 67% of the raw sewage entering the Calumet (a large industrialized plant) facility is of the complex form, and that cyanide generally predominates in the complex form. Because there are non-industrial sources of cyanide in domestic waste waters that would not be controllable through industrial waste enforcement, it was concluded that effluents from municipal treatment plants would have low levels of total cyanide in excess of the present IPCB standard at least some of the time. Further investigation is recommended to determine the proportions of simple and complex cyanide compounds found in effluents and their relative toxicities, in order to evaluate the numerical limit for cyanide level. (Kramer-FIRL)
W76-03247

FATE OF WASTEWATER PHOSPHORUS IN SOIL,
Robert S. Kerr Environmental Research Lab., Ada, Okla. Water Quality Control Branch.
For primary bibliographic entry see Field 5B.
W76-03250

EFFECT OF HALOGENS AND OZONE ON SCHISTOSOMA OVA,
Virginia Polytechnic Inst. and State Univ., Blacksburg. Dept. of Civil Engineering.
For primary bibliographic entry see Field 5C.
W76-03252

RESEARCH NEEDS FOR WATER RESOURCES CONTROL IN CALIFORNIA.
California State Water Resources Control Board, Sacramento. Div. of Planning and Research.
For primary bibliographic entry see Field 5G.
W76-03265

COMPUTER PRINT-OUT SHEETS. USER'S MANUAL, INTEGRATED AMMONIA MODEL.
Houston Univ., Tex.
Available from the National Technical Information Service, Springfield, Va 22161 as PB237-221, Price $5.00 in paper copy, $2.25 in microfiche. National Science Foundation, Report No NSF/RA/E-74-007B, 1974. 100 p. NSF-GI-34459.

Descriptors: *Ammonia, *Chemical industry, *Computer programs, *Model studies, Chemical wastes, Water utilization, Consumptive use, Cost analysis, Energy, Water treatment, Natural gas, Texas, Cooling towers, Electric power, Steam, Fuels, Waste water(Pollution), Cooling water, Heat transfer, Dissolved solids, Demineralization, Waste disposal, Effluents, Nuetralization.
Identifiers: Houston(Tex).

Sample computer outputs from a model relating water and energy use and water treatment to costs for an ammonia plant are shown. The plant produces ammonia from natural gas. The integrated ammonia model (Houston parametrics) contains information on energy, pressure reduction, fuels, electricity, natural gas, naphtha, methane, ammonia, salt, steam, water, waste heat and water, demineralizer outputs, river water, blowdown solids, dissolved solids, suspended solids, cooling (once through, recycled, and air), heat transfer vectors, flash evaporation, effluent disposal clarification, landfill disposal, and costs. (Buchanan-Davidson--Wisconsin).
W76-03282

CHANGING WATER USE IN SELECTED MANUFACTURING INDUSTRIES,
National Bureau of Economic Research, Inc., Washington, D.C.
For primary bibliographic entry see Field 3E.
W76-03284

INTERDEPENDENCE OF AIR, WATER, AND SOIL POLLUTION CONTROL STRATEGIES IN A POWER PLANT AND A KRAFT MILL,
Battelle Columbus Labs., Ohio.
P. Choi, N. Dee, and H. Reiquam.
Water, Air, and Soil Pollution, Vol 4, No 3-4, p 381-394, 1975. 6 fig, 4 tab, 10 ref. CEQ 315.

Descriptors: *Pollution abatement, Analysis, *Control systems, Air pollution, Water pollution, Soil contamination, Powerplants, Coals, Pulp wastes, Industrial wastes, Pollutants, Technology, Capital costs, Operating costs, Electric power, Environmental effects, Waste disposal.
Identifiers: *Emissions, Coal-fired powerplants.

The cross-media (air, water, and soil) impacts from various control strategies in coal-fired power plants and kraft mills must be evaluated prior to their application. Such information includes in-

tegrated qualitative and quantitative data on primary and secondary emissions to all media, energy requirements, raw material usages, and capital and operating costs. This information can be obtained from an engineering analysis of control strategies and emission data. The procedure and results of such analyses are presented on seven control strategies for a 1000 MW coal-fired power plant and ten control strategies for a 1000 air-dried ton of pulp per day kraft paper mill. Uncontrolled pollutant emissions, controlled emission levels, and results for each control technology are described. Evaluation of control strategies for only one medium may mislead the overall effectiveness of the strategies, consequently evaluations should be based on controls for air, water, and soil. If environmental impacts for unit pollutant emission vary depending on the type of pollutant, efforts may be necessary to measure the magnitude of damages created by various pollutants and to assess the relative importance or significance of damages to the environment. Factors such as capital and operating costs, energy requirements, and resource needs are incorporated in the evaluations. (Buchanan-Davidson--Wisconsin).
W76-03297

BIBLIOGRAPHY OF WATER POLLUTION CONTROL BENEFITS AND COSTS,
Development Planning and Research Associates, Inc., Manhattan, Kans.
For primary bibliographic entry see Field 5G.
W76-03298

THE EFFICIENCY OF HEAVY METAL REMOVAL BY A CONVENTIONAL ACTIVATED SLUDGE TREATMENT PLANT,
Canada Centre for Inland Waters, Burlington (Ontario).
B. G. Oliver, and E. G. Cosgrove.
Water Research, Vol 8, p 869-874, 1974. 3 fig, 4 tab, 10 ref.

Descriptors: *Heavy metals, *Sewage treatment, *Sewage sludge, *Activated sludge, Efficiencies, Treatment facilities, *Waste water treatment.

The total and dissolved concentration of cadmium, chromium, cobalt, copper, iron, lead, manganese, mercury, nickel, and zinc at various points in a conventional activated sludge treatment plant were measured. Samples of raw sewage, primary effluent, aeration tank contents and final effluent were collected hourly for a 3-day period and a 4-week period, then analysed individually and as 8-h composites on a proportion to flow basis, respectively. The analysis of raw sewage samples collected hourly over the 3-day period showed that metal inout to the plant was not a continuous process, but consisted of slugs of metal lasting for a discrete time. The efficiency of heavy metal removal by this model treatment plant was determined by monitoring the influent and effluent metal levels over the 4-week period. It was shown that the activated sludge treatment process does remove heavy metals to a certain degree. All the metals removed are concentrated in the sludge. Improvements and possible need for tertiary treatments are discussed. (Hoyle-Vanderbilt)
W76-03306

OXYGEN TRANSFER IN FERMENTATION,
Iowa State Univ., Ames. Dept. of Chemical Engineering.
For primary bibliographic entry see Field 5A.
W76-03321

COMPUTER CONTROLS PUT 'WASTE' WATER TO GOOD USE,
Central Contra Costa Sanitary District, Walnut Creek, Calif.
G. A. Horstkotte, Jr., and D. G. Niles.
The American City and County, Vol 90, No 10, p 55-56, October, 1975.

Descriptors: *Computers, *Control systems, *Waste water treatment, *Sewage treatment, Treatment facilities, *California, Water reuse, Economics.

Computer control is used in reclaiming up to 30 mgd of effluent from the Central Contra Costa Sanitary District, California, sewage treatment facility. The reclaimed effluent will be sold to the Contra Costa Water District, who will then sell it to refineries, chemical industries, and power plants for use as cooling and process water. The effluent must be a high quality, essentially free of contamination and nutrients. The waste water reclamation plant will achieve this quality with a process of high-lime treatment, biological denitrification, and mixed media filtration. The water quality is maintained by a direct digital control (DDC) system, one of the first of its kind in the United States. All process functions are controlled and monitored directly. One part of the dual computer acquires data and controls process functions while the other handles off-line functions and provides standby capability. Only about 88% of the manpower needed for a comparable conventionally controlled facility is required to operate the Contra Costa plant. The 30 mgd plan will eventually be expanded to a 120 mgd capacity. Laboratory and pilot studies are underway, and energy recovery by burning some of the municipal solid waste of the area is a major priority for future construction. (Kramer-FIRL)
W76-03323

WATER AUTHORITIES' RESEARCH NEEDS,
P. Stott.
Water, No 5, p 16-26, October, 1975.

Descriptors: *Research and development, *Water treatment, *Sewage treatment, *Waste water treatment, Water resources development, Water quality, Economics, Recycling.
Identifiers: Cost-effectiveness, Water authorities(Great Britain).

Research needs were outlined by the Water Research Center (WRC), Great Britain, for the areas of water treatment and quality, sewage treatment, coasts and estuaries, water distribution and sewerage, sludge treatment and disposal, resources management, and fisheries and recreation. Problems and priorities were defined; the recommendation that the WRC and Water Authorities (WAs) work cooperatively was made. The dominant problems for water and waste water treatment are economics and water quality. Quality problems in water treatment are often linked with distribution. For England and Wales, assessing water treatment costs was difficult because marginal treatment costs will be higher than present treatment costs. It was found, however, that water treatment costs are less than sewage treatment costs and of a lower order of magnitude than the costs of water mains. Cost-effectiveness is central to the problems in sewage treatment. The capital investment in new and extended sewage works is now over L1000 m per year. Savings could be achieved in the operation and maintenance of small sewage works if more data were obtained on their tolerance to loading variations. In the field of sewers and water mains, operational problems directly influence costs. Current spending on pipes by WAs represents more than half their capital investment and the improvement of technology and materials has a high priority. Sewage sludge treatment and disposal, which now requires an annual capital expenditure of over L35 m, may be improved by encouraging research in agricultural applications or in the recycling and reuse of sludge by-product. (Kramer-FIRL)
W76-03325

RE-USE OF SEWAGE EFFLUENT AND SLUDGE,
A. J. Francis, J. R. Coldrick, and M. A. Stonebridge.
Journal of the Institution of Water Engineers and Scientists, Vol 29, No 4, p 196-200, June, 1975. 13 ref.

Descriptors: *Recycling, *Water reuse, *Sewage effluents, Sewage sludge, *Sludge disposal, Waste disposal, Activated sludge, Water resource development, Organic compounds.
Identifiers: Municipal-industrial wastes.

The prospects for reuse of sewage effluent and sludge in Great Britain were examined. The annual expenditure on sludge disposal is L10 to L20 million; with proper reclamation of water, gas, and specific chemicals, this sludge might be made to yield a profit. Several examples of economic reuse were provided. In one case, 3 mgd of water recovered from sewage effluent (after secondary treatment) has been sold to local industry by the Avonmouth sewage treatment works for yearly return of L61,000. Sewage sludge has been used as a soil conditioner or fertilizer but must be closely monitored for heavy metal content. Several facilities where sludge is dried and sold to farmers and market gardeners are described. Another example of reuse is the utilization of the methane gas produced by sludge digestion. At many sewage treatment works this gas is collected to power dual-fuel generators and turbines. Protein from activated sludge has been separated and fed to animals as a nutritional supplement. Specific organic chemicals (proteins, amino acids, nucleic acids, enzymes and vitamins) might also be extracted. Additionally, grease (from municipal-industrial waste streams) combined with sewage effluents has been recovered at the Eshold Works, Bradford and has been resold to industry as a fuel oil. Other miscellaneous products of sewage and sludge include paper, oil, plastics, and adsorbents. To achieve an optimal reclamation of these resources, support in marketing and publicity by the Regional Water Authorities and the national government are needed. (Kramer-FIRL)
W76-03326

REAL OR RASH REGIONALIZATION,
For primary bibliographic entry see Field 5F.
W76-03327

THE UTILISATION OF SEWAGE SLUDGE,
R. Wood.
Effluent and Water Treatment Journal, Vol 15, No 9, p 455-457, 459-461, September, 1975. 4 tab, 9 ref.

Descriptors: *Sewage sludge, *Sludge, *Sewage treatment, Land use, Toxins, Anaerobic digestion, Pollutant identification, *Waste water treatment, Waste disposal, Agriculture, Sludge disposal, Land management.
Identifiers: Land application, Agricultural uses.

The utilization of sewage sludge based upon its composition and properties is studied. It is difficult to define the properties of sewage sludge, since it comes in a wide variety of types, dependent on where it comes from, and what stage of processing it is in. Sludge can be utilized in methane production or fertilizer, both of which have been tried successfully. Proposed uses include wallboard manufacture, smokeless fuel production and metal recovery. It is uneconomical to recover metals from sewage sludge, but the high cost of metals could encourage recovery at the factory, before it becomes sewage. Agricultural uses of sludge have been interrupted since the Industrial Revolution because the concentrations of populations have produced more organic wastes than the land can take back and industrial development has increased the amount of toxins or potential toxins in the sewage, making it undesirable to return it back to the land. Anerobic fermentation processes have been successful in rendering most of these wastes environmentally acceptable. There are four problems and dangers of sludge use in agriculture: distribution, marketing, effects of ex-

ternal circumstances, and quality control of the product and its use. It is necessary to have strict controls and codes concerning the quality of sewage and its application to the land. (Pinto-FIRL)
W76-03328

EFFECTS OF DETERGENT FORMULATION ON WASTEWATER CHARACTERISTICS AND TREATMENT,
Black, Crow and Eidsness, Inc., Gainesville, Fla.
E. E. Shannon.
Journal Water Pollution Control Federation, Vol 47, No 10, p 2371-2383, October, 1975. 11 fig, 7 tab, 17 ref.

Descriptors: *Environmental effects, *Detergents, *Waste water treatment, *Phosphorus, Biodegradation, Biological treatment, Carbonates, Canada, Activated sludge, Metals, Nitrilotriacetic acid.
Identifiers: Citrates.

Results of full-scale detergent substitution tests are presented, from a study: to assess the relationship between detergent formulation and phosphorus removal with calcium, aluminum, and iron salts; to assess the biodegradability of the detergent builder materials when they are subjected to biological treatment, and their impact on the efficiency of the biological waste water treatment process; and to assess the relative effects of four (NTA, citrate, carbonate, and phosphate) laundry detergent formulations on municipal waste water characteristics. These studies were carried out at the Canadian Forces Station, Gloucester, near Ottawa, Canada. It was found that by substituting nonphosphate detergents for existing detergents, an average reduction of 24% in total phosphorus content of domestic waste water was achieved. In a longer duration, larger-scale study, a 56% reduction was observed. Significant diurnal variations in waste water condensed phosphorus, NTA, citrate, sodium, silica, and alkalinity were seen, attributable to use of various detergent formulations. NTA was degraded by the activated sludge system, 61% under NTA substitution conditions. Winter and summer citrate removals over 60% could be expected from a well-operated activated sludge plant. The NTA-mercury, NTA-cadmium and NTA-nickel complexes showed poor degradability in a laboratory activated sludge system; in temperatures under 10 C, reduced NTA degradability may lead to increased metal levels in plant effluent. Detergent-induced increases in NTA or citrate levels did not have any quantifiable effect on phosphorus removal with alum, ferric chloride or lime. (Kramer-FIRL)
W76-03329

TECHNIQUES FOR INDUSTRIAL ODOR CONTROL,
P. N. Cheremisinoff, R. M. Bethea, T. M. Hellman, and O. B. Lauren.
Pollution Engineering, Vol 7, No 10, p 24-31, October, 1975. 6 fig, 4 tab.

Descriptors: *Ozone, *Odor, *Industrial wastes, *Sewage treatment, *Waste water treatment, Oxidation, Chlorine, Adsorption, Absorption, Activated carbon, Treatment facilities, Economics.
Identifiers: Physico-chemical treatment.

The principal methods for controlling odors from manufacturing processes and sewage treatment are outlined. Physical containment of odors may be accomplished either by changing the process producing the odors or by improving maintenance. Various types of oxidation by combustion (direct combustion at 2500 F, thermal oxidation at 1000-1500 F, or catalytic oxidation at 600-900 F) have been popular; however, with rising fuel costs this control technique is no longer economically attractive. A common adsorption material for removal of both inorganic and organic odorants is activated carbon. Most organics with molecular weights greater than 45 and boiling points over 0 C will be adsorbed. Methods of odor removal by absorption were also compared. These could be achieved using ozone, chlorine, sodium hypochlorite, hydrogen peroxide, or potassium permanganate. Ozone has successfully been applied for the control of odors from waste water treatment facilities. Uses include oxidizing sulfides and amines to nonodorous sulfoxides and amino oxides in grit and screening chambers, aeration tanks, vacuum filters, and storage tanks. (Kramer-FIRL)
W76-03330

OXYGENATION AND WASTEWATER TREATMENT.
Environmental Science and Technology, Vol 9, No 10, p 910-915, October, 1975.

Descriptors: *Activated sludge, *Oxygenation, *Municipal wastes, Industrial wastes, Cryogens, Tanks, *Waste water treatment, Biological treatment.
Identifiers: UNOX, OASES, F30, MAROX, Rotating active diffuser(RAD).

A report was made on the widespread use of oxygenation in the activated sludge process and on the four companies which produce oxygenation systems. The oxygenation process allows space savings of one third and increases gaseous solubility about 5 times. It is now used mainly for the treatment of municipal waste waters, but future applications to combined municipal and industrial waste waters and to industrial waste waters with high BOD values are planned. Union Carbide's closed UNOX system was the first developed, and it has about 90% of the oxygenation market in America. There are also UNOX operations in Japan, Europe and the United Kingdom. Air Products OASES is a gas-tight closed reactor and was the first on-stream oxygenation system. Air Products is the chief advocate of cryogenic plants as an oxygen supply system, because of their efficient use of energy. Air Products is prepared to enter the international market. Airco's F30 process uses an open tank and the forced free fall of oxygen. Its units are completely automatic. One is in use at a municipal site and one at an industrial operation. Four MAROX plants, produced by the FMC Corporation, are under construction. The MAROX system uses a Rotating Active Diffuser (RAD). The major benefit of the MAROX system is its operation in open tanks which eliminates costly covers and baffles and entrapment of potentially hazardous gases. Another major benefit is the ability to install a MAROX system in existing basins with virtually no tank modifications. (Beale-FIRL)
W76-03331

THE BIOLOGICAL PURIFICATION OF WASTE WATER IN CARROUSEL PLANTS (DIE BIOLOGISCHE REINIGUNG DES ABWASSERS IN CARROUSELANLAGEN),
F. P. Van Schagen, and J. Jeper.
Wasserwirtschaft, Vol 65, No 10, p 257-262, October, 1975. 7 fig, 3 tab, 6 ref.

Descriptors: *Waste water treatment, *Sewage treatment, Aeration, Equipment, Treatment facilities, Flow, Nitrogen, Phosphorus, Nutrient removal, Sludge treatment, Dewatering.
Identifiers: *Carrousel system, Belt presses, Filter presses.

The trend of the costs of construction and energy over the past twenty years has caused the development of increasingly large facilities for sewage treatment, using the Pasveer principles. This development has been significantly affected by the design of the Carrousel system. In this system, surface aerators are used for oxygenation and an orbital flow is generated at the same time, resulting in a series of completely mixed aeration zones and plus flow channels. In addition to the economical advantages of the Carrousel system, the efficiency of nitrogen removal is increased and simultaneous removal of phosphorus with Fe2+ can also be effected. After chemical conditioning, the aerobically stabilized sludge from a Carrousel plant can be dewatered on belt presses or on filter presses. (Orr-FIRL)
W76-03332

WASTE WATER TREATMENT WITH AN SO2 REMOVAL BY-PRODUCT,
Tri-State Coll., Angola, Ind.
P-W. Lin.
Journal Water Pollution Control Federation, Vol 47, No 9, p 2271-2280, September, 1975. 11 fig, 5 tab, 14 ref.

Descriptors: *Waste water treatment, *Phosphates, *Turbidity, Economic efficiency, Lime, Calcium sulfate, Air pollution, Byproducts.
Identifiers: Acid neutralization, *Sulfur dioxide removal.

Methods for using the by-products of an atmospheric pollution control process in waste water treatment are described. Laboratory produced by-product has been demonstrated to be suitable for waste water treatment by acid neutralization, as a binder for flyash to produce construction materials, and for phosphate and turbidity removal. The by-product contains unspent lime and anhydrous calcium sulfate. The lime, located in the core of the by-product particle, reacts with contaminated water that seeps through its calcium sulfate shell. The CaO in the by-product reacts quickly with orthophosphate. The removal efficiency of PO4 from phosphate contaminated water by by-products, as by high-calcium lime, is a function of sedimentation time. The efficiency of PO4 removal from raw waste water by the by-product is about the same as or better than that by high-calcium lime at the same CaO dosage level and sedimentation time. The by-product is better than high-calcium lime in turbidity removal from raw waste water. The use of the by-product to remove phosphate and turbidity from waste water makes the air pollution control process more economical. Pilot plant studies are planned to develop waste water treatment systems to work in coordination with the atmospheric control process. (Beale-FIRL)
W76-03333

THE USE OF HIGH-PURITY OXYGEN IN SEWAGE TREATMENT,
T. P. Lewandowski.
Effluent and Water Treatment Journal, Vol 15, No 8, p 401-405, August, 1975. 4 fig, 3 ref.

Descriptors: Equipment, *Sewage treatment, *Activated sludge, *Oxidation, *Sludge treatment, *Oxygen, Organic loading, Biochemical oxygen demand, Dissolved oxygen, *Waste water treatment.
Identifiers: *Unox System, Energy use.

A report was made on the successful use of oxygen in the activated sludge process. Advantages of the use of high purity oxygen are a reduction in land requirements, reduction in power requirements, and an increased ease of operation due to a highly flocculant and thicker sludge. The Union Carbide Corporation had developed a commercial viable oxygen system known as Unox. The Unox system is composed of an aeration tank and an on-site oxygen generator. Because it achieves MLSS concentrations higher than those of conventional systems, Unox allows for reduced tank volumes and commensurate savings in cost. It generates oxygen by cryogenic distillation of liquid air, which is most economical for larger plants, or by the new process of ambient-temperature separation which uses molecular sieves. The Unox system allows for operation at higher organic loadings than normally expected: high quality effluents are achieved at 0.5-0.7 kg BOD/d kg MLVSS, and it has consistently shown a reduction in the amount

of surplus sludge produced. This reduction is due both to higher concentrations of MLSS which increase the effect of endogenous respiration, and to a more complete oxidation because of the high DO concentration which maintains high activity in the reactor. The Unox method of process control keeps power consumption to a minimum, based on the enclosure of the reactor tank in a gas-tight cover. Due to this arrangement, the horse power needed to generate oxygen is directly related to the load. (Beale-FIRL)
W76-03335

POLYELECTROLYTES IN PRESSURE FILTRATION: EXPERIENCES AT FARNHAM,
B. R. Charlesworth, R. A. Knott, and R. A. Fox.
Effluent and Water Treatment Journal, Vol 15, No 8, p 411-412, 414-415, 417, August, 1975. 2 fig, 2 tab.

Descriptors: *Waste water treatment, *Sewage treatment, *Sludge treatment, *Polyelectrolytes, Costs, Filtration.
Identifiers: Filter pressing, Chemical conditioning agents, Polyelectrolyte conditioning agents.

The use of polyelectrolytes in the pressure filtration of sludge has the following advantages: low capital costs of conditioning systems; possibility of reduced treatment costs in comparison with traditional chemicals, potential of increased filter press capacity and shorter pressing times; ease of product preparation and application; and, elimination of equipment scaling and corrosion. The use of polyelectrolytes in pressure filtration at the Farnham Water Pollution Control Works (Great Britain) is discussed. The Farnham plant was originally designed for operation with aluminum chlorohydrate as the chemical conditioning agent. However, the larger than design quantity of reagent necessary, the severe water/sludge separation, and heavy filter blinding made this chemical unacceptable. Tests were performed on a range of polyelectrolytes. Capillary suction time (CST) measurements indicated that Zetag 63 was the most promising conditioning agent. Fullscale tests confirmed the ability of Zetag 63 to satisfactorily condition the sludge for filter pressing. The polyelectrolyte was then put into full-plant operation. Performance with Zetag 63 as an on-line rather than batch conditioning system was an efficient system. Tests run with aluminum chlorohydrate as an on-line system, and with ferric chloride and lime as batch systems confirmed that Zetag 63 is a more satisfactory conditioning agent. Between 2 and 3 kg of Zetag 63/ton of dry solids are used at Farnham; the chemical costs are much less than they would be for Al203, FeCl, or lime. (Orr-FIRL)
W76-03336

FILTRATION IN TERTIARY TREATMENT FOR SEWAGE WATER (GESUI NO SANJIGEN SHORI NI OKERU ROKA),
T. Matsuura.
Mizushori Gijutsu, (Water Purification and Liquid Waste Treatment), Vol 16, No 6, p 551-558, 1975. 12 fig, 3 tab.

Descriptors: *Tertiary treatment, *Filtration, Turbidity, Biochemical oxygen demand, *Waste water treatment, Treatment facilities, Coagulation, Chemical precipitation.
Identifiers: Alum, Anthracite, Sand filters.

Tertiary treatment of waste water effluent from a secondary treatment facility was studied by a filtration technique using anthracite and sand as the filtration materials. Filtration efficiency was determined by the turbidity ratio between the filtered water and sample water. The efficiency increased with the increased height of the filtration layer, slower filtration speed, and smaller particle sizes of filtration materials. Based on these preliminary data, an experimental plant was constructed, in which a filtration tower 300 cm in height with a 60 cm diameter, and double layer of anthracite and sand was employed. The particle size of filtration material used was the effective particle diameter of 1.0 to 2.8 mm for anthracite, and 0.4 to 0.9 mm for sand. The experimental plant had the water treatment capacity of 2.8 to 5.6 cu m/hr depending upon the filtration speed (linear velocity 10 to 20 m/hr). Three techniques were used: direct filtration; coagulation filtration with aluminum sulfate; and coagulation/precipitation/filtration with aluminum sulfate in which the sample water was precipitated upon coagulation with alum prior to the filtration. The last filtration method gave the best results in the quality of treated water. By this method, more than 80% of the original turbidity could be removed and the turbidity in the treated water was less than 5. The efficiency of BOD removal was over 70% to ensure the 10 ppm level of BOD in the treated water. The removal of COD and TOC were not as great; however, 30 to 50% efficiency were obtained. (Katayama-FIRL)
W76-03337

CORRELATION OF VARIOUS MONITORING ITEMS REGARDING POLLUTION SUBSTANCES OF HUMAN WASTES AND TREATED WATER (SHINYO TO SONO SHORISUI NO ODAKU SIBUN NI KANSURU KAKUSHU SOKUTEI KOMOKU KAN NO SOKAN NI TSUITE),
For primary bibliographic entry see Field 5A.
W76-03342

METAL CONCENTRATIONS IN THE SEWAGE, EFFLUENTS, AND SLUDGES OF SOME SOUTHERN ONTARIO WASTEWATER TREATMENT PLANTS,
Canada Centre for Inland Waters, Burlington, Ontario.
For primary bibliographic entry see Field 5A.
W76-03343

COMPARATIVE STUDIES ON THE ACTION OF CHLORINE AND OZONE ON POLIOVIRUSES IN THE REPROCESSING OF DRINKING WATER IN ESSEN (VERGLEICHENDE UNTERSUCHUNGEN UEBER DIE WIRKUNG VON CHLOR UND OZON AUF POLIOVIREN BEI DER TRINKWASSERAUFBEREITUNG DER STADT ESSEN),
For primary bibliographic entry see Field 5F.
W76-03345

THE DESTRUCTION OF PARASITIC RESISTANT STAGES IN SLUDGE BY IRRADIATION WITH LOW ACCELERATING VOLTAGE ELECTRONS (DIE VERNICHTUNG PARASITAERER DAUERFORMEN IM KLAERSCHLAMM DURCH BESTRAHLUNG MIT NIEDERENERGETISCHEN ELEKTRONEN),
K. Enigk, P. Holl, and A. Dey-Hazra.
Zentralblatt fuer Bakteriologie, Parasitenkunde, Infektionskrankheiten und Hygiene, I. Abteilung Originale Reihe B, Vol 161, No 1, p 61-71, 1975. 1 tab, 8 ref.

Descriptors: *Waste water treatment, *Sludge treatment, *Irradiation, Disinfection, Parasitism, Radiation.
Identifiers: *Ionizing radiation, Electrons.

An investigation was performed on the effect of ionizing radiation on parasitic resistant stages in sludge. An electron beam accelerator can be used for this process. The accelerator is provided with energy from an electric power supply network which can be switched on and off according to the requirements. These units have a large beam capacity and high operating safety. The process is conducted with a continuous flow and at room temperature. The effect of different radiation doses was tested in 13 experiments. An economically acceptable dose of 480 kRad (accelerating voltage: 400 kV, beam current: 10 mA, and irradiation time: 24 sec) can be easily achieved in practical situations. Approximately 97% of the following parasitic stages have been destroyed by a 480 kRad dose: undeveloped eggs of Ascaris suum, Trichuris suis, and Fasciola hepatica; gastrointestinal strongylids of pigs; and, embryonated eggs of Capillaria obsignata and Taenia spec. A few third-stage larvae of Oesophagostomum (Strongylide) of pigs survived 108 sec of irradiation, however, these did not develop to maturity in the definitive host. About 25% of the sporulated oocysts of Eimeria tenella were still infective after 108 sec of irradiation. (Orr-FIRL)
W76-03346

THE REMOVAL OF INORGANIC NITROGEN FROM SEWAGE EFFLUENTS BY BIOLOGICAL DENITRIFICATION,
Water Pollution Research Lab., Stevenage (England).
D. A. Bailey, and E. V. Thomas.
Water Pollution Control, Vol 74, No 5, p 497-512, 1975. 13 fig, 5 tab, 54 ref.

Descriptors: *Nitrogen, *Nitrates, *Nitrites, Sewage, *Sewage effluents, Effluents, *Denitrification, *Biological treatment, *Inorganic compounds, Filters, Sands, Bacteria, Potable water, Anaerobic conditions, Activated sludge, Sludge, *Waste water treatment, Nitrification, Laboratory tests.
Identifiers: Methanol, Molasses, Biological filters, Methaemoglobinaemia, Heterotrophic bacteria.

Drinking water containing nitrate, when ingested by infants, can cause methaemoglobinaemia when the nitrate is reduced to nitrite by certain bacteria present in the infant's digestive tract. Of all nitrification and denitrification processes known, biological processes seem to be the best suited to the conditions and climate of the United Kingdom. Laboratory experiments carried out on biological denitrification are discussed. Certain types of heterotrophic bacteria, which are capable of altering their metabolism in order to use nitrate as a source of oxygen, are used in the processes. It was found that methanol and molasses were the most suitable candidates for sources of carbon; methanol was used in this study. Two different designs or process modifications were used: flooded biological filters and anaerobic or semi-anaerobic adaptations of the activated-sludge process. The flooded filters contained either 25 mm pebbles or 5 mm pebbles. The coarseness had no effect on the efficiency of nitrate removal; at retention periods of one hour, both reduced the nitrate content by about 90%. Temperature had the effect of retarding the process. Nitrate removal at 23C was about 95% and at 7C was about 48%, both after 8 days of operation. After 38 days of operation, 80% was removed at 23C and 71% was removed at 7C. The activated sludge processes are of two types: one in which a specific sludge is developed for denitrification alone and one in which a sludge is used for both nitrification and denitrification at the same time. Testing continues on their relative merit. (Pinto-FIRL)
W76-03347

SPRAY RUNOFF DISPOSAL OF WASTE STABILIZATION POND EFFLUENT,
Environment Canda, Ottawa, Environmental Protection Service (Ontario).
N. Ehlert.
Training and Technology Transfer Division (Water), Research Report No 22, July, 1975. 24 p, 3 fig, 6 tab, 5 ref.

Descriptors: *Waste water treatment, *Municipal wastes, *Irrigation, Sprinkler irrigation, Runoff, Water quality, Waste water disposal, Permeability, Soils, Erosion, Waste disposal.
Identifiers: Land application.

An investigation of spray runoff techniques for land disposal of sewage effluents was conducted at the Smithville, Ontario, Canada, waste stabilization pond site. Although the study was originally designed to compare the irrigation-infiltration process to runoff disposal on a heavy clay soil with low permeability, it was also concerned with the runoff operation and effluent quality improvement. The waste stabilization pond effluent was sprayed on an area of soil with a slope of 5 percent, and a permeability, K less than or equal to 0.14 in/hr for two growing seasons. A combined waste stabilization pond-runoff system is capable of reducing the phosphorus loading on a receiving stream by 90%. The hydraulic input to the receiving stream may be reduced by 50% by this system. This system is feasible as long as the rates and duration of application do not result in soil erosion and/or damage to vegetation. The total phosphorus and BOD levels in the runoff satisfied the current discharge standards for sewage treatment plant effluents. However, the suspended solids levels exceeded the current limits, possibly because of minor erosion. (Orr-FIRL)
W76-03348

LAND SPREADING OF INDUSTRIAL WASTE WATER AND THE EFFLUENT FROM A SECONDARY TREATMENT FACILITY,
General Electric Co., St. Petersburg, Fla. Neutron Devices Dept.
W. E. Ward, and D. V. Gray.
Available from the National Technical Information Service, Springfield, Va 22161, as GEPP-127, $3.50 in paper copy, $2.25 in microfiche. Report No GEPP-127, November, 1974. 6 p, 2 fig, 1 tab.

Descriptors: *Waste water treatment, *Industrial wastes, *Municipal wastes, Irrigation, Florida, Biological treatment, Nutrient removal, Phosphates, Nitrogen, Biochemical oxygen demand, Waste water disposal, Capital costs, Operating costs, Tertiary treatment.
Identifiers: Land application.

The Pinellas Plant of the General Electric Company, located in west central Florida, treats its industrial and sanitary wastes by land spreading, coupled with a subsurface drainage system. Industrial wastes are discharged to a neutralization facility where the acidic pH is adjusted. Approximately 42,000 gpd are then discharged into the west retention lake. Sanitary wastes are pumped to a 20,000 gpd activated sludge sewage treatment plant. The plant removed 97% of the BOD and suspended solids, but does not remove nitrogen and phosphorus. After chlorination, the sewage is also released to the west retention lake. The combined wastes are retained in the west retention lake for an average of 40 days while being continuously aerated. Water from the west lake is spray applied to the irrigation field. Four-inch perforated polyethylene pipes surrounded by gravel form the underground drainage system. Water collected in the drain sump is directed to the east lake. Discharges from this lake are controlled by a Parshall flume equipped with a recorder and a continuous flow integrator connected to an automatic proportional sampler. The system achieves a 69% reduction in total nitrogen, a 72% reduction in BOD, and a 87% reduction in phosphates. The capital cost of the land spreading system was about $40,000. Operating costs for 1973 were $750 for treating 20 million gallons of effluent. (Orr-FIRL)
W76-03350

REVERSE OSMOSIS OF TREATED AND UNTREATED SECONDARY SEWAGE EFFLUENT,
Eastern Municipal Water District, Hemet, Calif.
D. F. Boen, and G. L. Johannsen.
Available from the National Technical Information Service, Springfield, Va 22161, as PB-239 353, $7.75 in paper copy, $2.25 in microfiche. EPA-670/2-74-077, September, 1974. 217 p, 36 fig, 96 tab, 7 ref, 6 append.

Descriptors: *Tertiary treatment, *Waste water treatment, *Reverse osmosis, *Sewage treatment, Membrane processes, Membranes, Equipment, Costs, Water reuse, Groundwater, Recharge.

A pilot plant study was conducted using six commercially designed reverse osmosis (RO) pilot units to determine the feasibility of treating secondary effluent by reverse osmosis in order that the final effluent could be used as an integral part of the Hemet-San Jacinto (California) groundwater recycling program. The use of RO in the groundwater recycling program is relatively expensive in comparison with importing Northern California water. The effective post secondary treatment sequences include: alum clarification followed by sand filtration; sand filtration followed by granular activated carbon treatment; and, alum clarification followed by granular activated carbon treatment. Post secondary effluent treatment significantly reduces the cost of RO, and also lengthens the useful membrane life. The most effective membrane rejuvenation techniques are enzymatic detergent solutions, and a solution of EDTA acid. The use of higher Reynolds number flow conditions effectively retards membrane fouling. The spiral wound configuration and one of the tubular modules exhibited the best overall performance. Costs of reverse osmosis treatment are discussed, and comparisons are made between the different RO modules tested. (Orr-FIRL)
W76-03351

WASTE-PRODUCT POLLUTION OF BODIES OF WATER AND WASTE-WATER PURIFICATION,
For primary bibliographic entry see Field 5B.
W76-03352

ACTIVATED CARBON: OLD SOLUTION TO OLD PROBLEM, PART II,
For primary bibliographic entry see Field 5F.
W76-03443

ESTIMATING SLUDGE PRODUCTION AIDS IN FACILITIES DESIGN, PART II,
Mississippi State Univ., Mississippi State.
L. D. Benefield, C. W. Randall, and J. H. Sherrard.
Water and Sewage Works, Vol 122, No 9, p 100-102, September, 1975. 4 fig, 1 tab, 13 ref.

Descriptors: *Treatment facilities, *Design criteria, *Activated sludge, *Waste water treatment, Anaerobic digestion, Mathematical studies, Model studies, Analytical techniques, Estimating equations.

As the second part of a two-part series on estimating the production of sludge for the design of treatment facilities, a sample problem is presented. This involves the estimation of the volume of raw sludge from a completely mixed activated sludge plant treating a municipal waste water flow of 10 mgd, using anaerobic digestion for sludge stabilization. It is assumed that the influent waste water temperature is 20 C; several other waste water is characteristics after grit removal are also outlined. A set of fourteen computations is presented, including: the volume of sludge removed during primary clarification in one day; the percent of BOD5 reduction during primary clarification; the observed yield coefficient, associated with a mean cell residence time of 16 days; the activated sludge production in one day; the concentration of the waste sludge when wasting is from the sludge line; the volumetric sludge wasting rate; volatile fraction of primary plus activated sludge mixture; the required digestion time for a digestion temperature of 80 F; the percent reduction in volatile solids during digestion; the weight of digested sludge produced in one day; the volume of digested sludge produced in one day; the volume of supernatant produced in one day; the influent BOD5 considering supernatant recycle; and the influent suspended solids concentration considering supernatant recycle. (Kramer-FIRL)
W76-03444

PRESENT AND FUTURE REQUIREMENTS OF THE CHLOR-ALKALI INDUSTRY FOR EFFECTIVE POLLUTION CONTROL,
Crawford and Russel, Inc., Stamford, Conn.
W. C. Gardiner.
In: Electrochemical Contributions to Environmental Protection, Theodore R. Beck, et al., editors. The Electrochemical Society, Inc., Princeton, New Jersey, 1972, p 16-28. 3 fig, 6 tab, 6 ref.

Descriptors: *Chlorine, *Alkalis(Bases), *Industrial wastes, *Chemical wastes, *Pollution abatement, Mercury, Sulfides, *Waste water treatment, Sludge treatment, Sludge disposal, Brines, Air pollution, Sodium compounds, Cooling water, Gases, Industries, Pollutants.
Identifiers: *Chlor-Alkali Industry.

In the United States, chlorine is produced in diaphragm, mercury, and Downs sodium cells. Concentrated brine is purified by addition of alkaline sodium carbonate and sometimes a barium salt, and filtered. For sodium and some mercury cell processes, purified brine is evaporated to obtain pure salt. Sulfate is discarded as sodium sulfate-sodium chlorine solution, sodium sulfate, barium sulfate, or calcium sulfate. Wastes from these processes are chlorine, sodium hydroxide, sodium chloride, sulfuric acid, hypochlorites, chlorinated hydrocarbons, calcium carbonate, magnesium hydroxide, sodium sulfate, asbestos, filter aids, mercury, lead, calcium oxide, sodium carbonate, calcium chloride, sodium-calcium sludge, graphite, rubble, and sludge. Wastes are controlled by separating cooling water from process water, recycling process water, settling ponds, and burying solids. Sodium-calcium sludge is returned to sodium cells. Methods of controlling mercury loss in products, sewers, atmosphere, and solid wastes are discussed. A flow sheet illustrates sulfide treatment of liquid wastes in chlorine plants. Processes using ion exchange and/or chelating agents for mercury recovery are described. Improvement of known methods, better mercury controls, mercury inactivation in solid wastes, mercury removal from air with negligible pressure drop, diaphragm cell caustic purification, new diaphragm material, and a permanent chlorine anode are still needed. (Buchanan-Davidson--Wisconsin)
W76-03497

5E. Ultimate Disposal Of Wastes

ONE PRIVATE PLANT TREATS OIL, CHEMICAL RESIDUES IN DENMARK,
For primary bibliographic entry see Field 5D.
W76-03073

ALTERNATIVE PROBLEM: COMMUNAL OR INDIVIDUAL PURIFICATION OF THE WASTE-WATERS GENERATED BY THE BIOLOGICAL INDUSTRIES IN THE LOUVAIN AREA (PROBLEMMSTELLING VAN HET ALTERNATIEF: GEMEENSCHAPPELIJKE OF INDIVIDUALE ZUIVERING VAN HET AFAVL-WATER VAN DE BIO-INDUSTRIE ROND LEUVEN),
For primary bibliographic entry see Field 5D.
W76-03085

TREATMENT AND DISPOSAL OF EFFLUENT FROM THE WOOL TEXTILE INDUSTRY,
For primary bibliographic entry see Field 5D.
W76-03095

EFFECTS OF GRAZING ON INFILTRATION RATES IN WASTE WATER SPRAY FIELDS,
Agricultural Research Service, Morgantown, W. Va. Plant Science Div.
For primary bibliographic entry see Field 5D.
W76-03124

EFFECTS OF OCEAN DISPOSAL ACTIVITIES ON MID-CONTINENTAL SHELF ENVIRONMENT OFF DELAWARE AND MARYLAND,
Environmental Protection Agency, Annapolis, Md. Annapolis Field Office.
For primary bibliographic entry see Field 5C.
W76-03175

ANNUAL SUMMARY OF RESEARCH RESULTS FOR FISCAL YEAR 1974, MESA NEW YORK BIGHT PROJECT.
National Oceanic and Atmospheric Administration, Boulder, Colo. Marine Ecosystems Analysis Program Office.
For primary bibliographic entry see Field 2L.
W76-03186

KILN DUST FROM CEMENT FACTORIES FOR VACUUM FILTER PROCESSING OF SEWAGE SLUDGE,
Pennsylvania State Univ., University Park. Dept. of Soil Chemistry.
For primary bibliographic entry see Field 5D.
W76-03214

CIRCULAR TANK SCRAPER.
For primary bibliographic entry see Field 8C.
W76-03222

EQUIPMENT FOR DEWATERING WASTE STREAMS,
Dorr-Oliver, Inc., Stamford, Conn. Environmental Technology.
For primary bibliographic entry see Field 5D.
W76-03227

FATE OF WASTEWATER BACTERIA AND VIRSUSES IN SOIL,
Baylor Coll. of Medicine, Houston, Tex. Dept. of Virology and Epidemiology.
For primary bibliographic entry see Field 5B.
W76-03251

RE-USE OF SEWAGE EFFLUENT AND SLUDGE,
For primary bibliographic entry see Field 5D.
W76-03326

FACING UP TO SLUDGE DISPOSAL IN NEW JERSEY,
S. Remley.
Compost Science, Vol 16, No 4, p 26-27, July-August, 1975.

Descriptors: *Waste disposal, *Sludge disposal, Soil science, Methane, Feed lots, Marshes, Soil contamination, Dredging, *Farm wastes, *New Jersey.
Identifiers: *Soil conditioners.

An on-going test has been conducted for the past three years at six sites in New Jersey to determine if treated sludge can be used as a soil conditioner. This study is one of the most extensive of this type in the world. Some off-site contamination was observed from the site which was receiving sludge at an application rate of 40 ton/acre/yr. The use of sludge as a soil conditioner at a 20 ton/acre/yr application rate is showing promise. Successful implementation of this type of disposal method could reduce by one-half the cost of disposing of sludge in landfills. Manure from animal feedlots as an economical source of methane gas is being investigated in Texas and Colorado. Bio Gas of Colorado, Incorporated, has built a plant to make 4 million cu ft of gas daily from 450,000 tons of cow manure yearly. Era is building a methane producing plant adjacent to a cattle feedlot in Deaf Smith County, Texas. A tidal marsh that is alternately flooded by water and then exposed to the sun and air and that has the ability to withstand and absorb wave action has been created near Hambleton Island, Maryland. An intertidal sand flat was first built and then planted with 60,000 seedlings. The experiment is part of a five year plan to explore new, ecologically acceptable uses for part of the 380 million cubic yards of sediment dredged up yearly by the corps. (Orr-FIRL)
W76-03341

SPRAY RUNOFF DISPOSAL OF WASTE STABILIZATION POND EFFLUENT,
Environment Canda, Ottawa, Environmental Protection Service (Ontario).
For primary bibliographic entry see Field 5D.
W76-03348

LAND SPREADING OF INDUSTRIAL WASTE WATER AND THE EFFLUENT FROM A SECONDARY TREATMENT FACILITY,
General Electric Co., St. Petersburg, Fla. Neutron Devices Dept.
For primary bibliographic entry see Field 5D.
W76-03350

USE OF JET PUMPS IN MARINE WASTE DISPOSAL,
Technion - Israel Inst. of Tech., Haifa.
Y. Argaman, M. Vajda, and N. Galil.
Journal of the Environmental Engineering Division, American Society of Civil Engineers, Vol 101, No EE5, Proceedings Paper 11639, p 703-711, October 1975. 7 fig, 1 tab, 10 ref, 2 append.

Descriptors: *Jets, *Diffusion, *Pumps, *Sewage disposal, *Waste water disposal, Environmental engineering, Model studies, Oceans, Waste disposal, Waste dilution, Stratification, Laboratory tests.
Identifiers: *Marine engineering.

The prime objective of a marine waste disposal installation is to maximize the physical dilution of wastewater with seawater. Very often the formation of a submerged plume is desirable. Application of the jet pump principle for achieving these objectives was investigated in a laboratory model. Tests were performed in both homogeneous and stratified environments. The experimental results and a theoretical analysis showed that in a homogeneous environment the use of a jet pump results in a significant increase of the initial dilution. Under stratification conditions, the use of a jet pump increased the probability of forming a submerged plume. However, the dilution obtained under these conditions was considerably lower compared to a simple jet. (Lardner-ISWS)
W76-03379

DO HEAVY METALS PREVENT THE AGRICULTURAL USE OF MUNICIPAL SLUDGE,
Royal Danish School of Pharmacy, Copehagen.
S. E. Jorgensen.
Water Research, Vol 9, p 163-170, 1975, 13 fig, 5 tab, 16 ref.

Descriptors: *Heavy metals, *Agriculture, *Sludge disposal, Groundwater, *Soil disposal fields, Soil treatment, Soil-water-plant relationships, Humus.

The chemical binding of heavy metals on different samples of soil was found. The pollution of heavy metals in soils by use of sewage sludge can be controlled by maintaining the pH at 7.0 or more and applying sludge preferably on soil with a high content of humus and clay. More than 200 tons of municipal sewage sludge can be applied per acre total, e.g. 20 tons per year over a 10 year period, without any danger. In most cases, lead is the metal limiting the amount of sludge that can be used due to its possible contamination of ground water. (Hoyle-Vanderbilt)
W76-03409

ORGANIC CHEMICALS IN DRINKING WATER,
California State Dept. of Health, Berkeley. Water Sanitation Section.
For primary bibliographic entry see Field 5F.
W76-03428

5F. Water Treatment and Quality Alteration

WATER SUPPLIES FOR LOW-INCOME COMMUNITIES IN DEVELOPING COUNTRIES,
Birmingham Univ. (England). Dept. of Civil Engineering.
R. G. Feachem.
Journal of the Environmental Engineering Division, American Society of Civil Engineers, Vol 101, No EE5, Proceedings Paper 11608, p 687-702, October 1975. 6 tab, 16 ref, 1 append.

Descriptors: *Water supply development, *Water quality control, *Water requirements, *Water quality, Hydraulics, Water allocation(Policy), Water supply, Cities, Diseases, Planning.
Identifiers: *Developing countries, *Water impacts, Water collection systems.

Examination of data on the availability of adequate water supplies in developing countries revealed an alarming state of affairs. This paper presented and analysis of the potential impact of a water supply in a poor tropical community and examined techniques for the quantification of this impact. Special attention was paid to the impact of a supply on the water collection journey (time and energy saving) and to the anticipated improvements in community health. A classification of water-related disease was presented and the effect of water supplies on various water-related infections was analyzed. A comprehensive table, showing the principle features of the water-related diseases, was included. It was shown how the analysis of water supply impacts, and in particular impacts on water collection and health, can facilitate improved designs and more rational resource allocation for water supply programs in developing countries. (Lardner-ISWS)
W76-03114

ECONOMIC ASSESSMENT OF AN ACTIVITY ANALYSIS MODEL FOR WATER SUPPLY PLANNING,
Utah State Univ., Logan. Dept. of Civil and Environmental Engineering; and Utah Water Research Lab., Logan.
For primary bibliographic entry see Field 5D.
W76-03163

WATER PURIFICATION MEMBRANES AND METHOD OF PREPARATION,
National Aeronautics and Space Administration, Moffett Field, Calif. Ames Research Center.
For primary bibliographic entry see Field 5D.
W76-03171

WATER MANAGEMENT IN ENGLAND: A REGIONAL MODEL,
North Carolina Univ. at Chapel Hill. Dept. of Environmental Sciences and Engineering.
For primary bibliographic entry see Field 6B.
W76-03207

ESTUARY TO BE STUDIED AS D.C. WATER SOURCE,
Illinois State Univ., Normal. Coll. of Applied Science and Technology.
A. R. Jacobson.
Public Works, Vol 106, No 10, 122, October, 1975. 1 fig.

Descriptors: *Water reuse, *Waste water treatment, *Treatment facilities, *Pilot plants, Design criteria, *Estuaries, Recycling, Operating costs, Capital costs, Research and development, District of Columbia, *Potomac River.
Identifiers: *Waste water reuse, Washington(DC).

An indirect waste water reuse plan is being considered to supplement the water supply of the metropolitan Washington, D.C. area. An experimental plant is being designed with a capacity of one mgd, to provide facilities and equipment for the study of several types of treatment processes. The experimental plant will test the treatment of water from the Potomac River Estuary, which receives Blue Plains waste water effluents. A central monitoring and control center will be available to sample the processes, which include: pretreatment, such as microscreening; coagulation, flocculation, and sedimentation; rapid sand filtration,; activated carbon adsorption; and final treatment via ozonation or chlorination, or by the choice of reverse osmosis, electrodialysis, or ion exchange, followed by disinfection. Estimated design and construction costs, are about $6 million and operating costs, including research, are expected to be $1.4 to $1.7 million per year. (Kramer-FIRL)
W76-03208

PLASTIC PUMP HANDLES ACID USED IN WATER SYSTEM.
For primary bibliographic entry see Field 8C.
W76-03217

HYGIENIC ASSESSMENT OF THE EXISTING TECHNOLOGY OF DRINKING WATER TREATMENT AND CERTAIN MEANS OF ITS IMPROVEMENT, (GIGIENICHESKAYA OTSENKA SUSHCHESTVUYUSHCHEY TEKHNOLOGII OCHISTKI PIT'EVOY VODY I NEKOTORYE PUTI EE ULUCHSHENIYA),
T. A. Nikolaeva, and I. P. Pletnikova.
Gigiena i Sanitariya, No 7, p 29-33, 1975. 1 tab.

Descriptors: *Water treatment, *Water works, *Treatment facilities, *Potable water, Pollutants, Ozone, Activated carbon.

Experimental and field investigations have been performed to determine the barrier role of water works. The capacity of water treatment facilities for removing chemical contaminants is very limited. No effective means for improving the existing methods of water treatment can be suggested at this time. Ozone treatment of potable water is not a universal means of removing chemical pollutants. The most effective and promising technique is activated carbon adsorption. (Orr-FIRL)
W76-03220

THE EFFECT OF CIRCULATION BAFFLES ON THE OXYGENATING EFFECT OF AERATORS OPERATING IN HORIZONTAL POSITION (WPLYW PRZEGRODY CYRKULACYJNEJ NA EFEKTY NATLENIANIA URZADZEN PRACUJACYCH NA WALE W POZYCJI POSIOMEJ),
W. Zymon.
Gaz, Woda i Technika Sanitarna, Vol 49, No 6, p 204-206, June, 1975. 5 fig, 1 tab, 8 ref.

Descriptors: *Flow, *Oxygenation, Analytical techniques, Hydrodynamics, Laboratory tests, *Aeration, Water purification, Mixing.
Identifiers: *Aerators, Oxygenation rates.

Hydrodynamic analysis of liquid flow in oxygenation tanks and ditches, equipped with horizontal, rotary aerators, may be used to demonstrate the adverse effects of a poor circulation pattern on oxygenation rate, purification process, and power consumption. The principal deficiency discovered was the formation of a partial closed-cycle flow pattern in the immediate vicinity of the aerator which quickly becomes saturated with oxygen. This prevents efficient utilization of the entire available volume. Tests conducted in an experimental tank (dimensions 1.35 x 0.7 x 0.32 m) equipped with a 0.316 m diameter aerator, with flat blades 0.03 m wide, demonstrated that installation of a baffle at a depth of 0.03 to 0.05 m below the aerator, and inclined at an angle of 10 to 35 degrees with respect to the water surface, will change the circulation pattern and result in a good mixing of the entire volume of the chamber. The oxygenation rate becomes then a linear function of the depth of immersion and of rotational velocity of the aerator. Increases of 32 to 80% in oxygenation capability have been achieved, resulting in a possible efficiency of 5000 g 02/kWh. (Czorpita-FIRL)
W76-03229

MODIFICATIONS IMPROVE CHLORINE CONTACT CHAMBER PERFORMANCE, PART I,
Worcester Polytechnic Inst., Mass. Dept. of Civil Engineering.
F. L. Hart, R. Allen, J. DiAlesio, and J. Dzialo.
Water and Sewage Works, Vol 122, No 9, p 73-75, September, 1975. 4 fig, 2 tab.

Descriptors: *Chlorine, *Water treatment, *Disinfection, Operating costs, Analytical techniques, Hydraulics, Pollutant identification.
Identifiers: *Chlorine contact tanks.

Studies have been conducted on modifications of the standard rectangular chlorine contact tank in order to improve the hydraulic efficiency. The two major variables in chlorine disinfection are concentration and time, and effective treatment is obtained by providing adequate dosage concentrations for the proper contact periods. While increasing dosages has been used as a method in the case of poor contact time, this practice has limitations because of problems caused by corrosive conditions experienced from too high concentrations, increased operating costs, and the inefficient utilization of chlorine. A successful chlorine contact chamber should achieve required disinfection levels as well as low operating costs and the discharge of an effluent safe for future uses. Two test evaluation methods are described for the modification of the standard chlorine contact tank to provide a more desirable hydraulic condition (plug flow). This modification is directly related to an increase in disinfection capability. Analysis was made of quantitative conventional dye tracer output response functions and qualitative evaluation of stream line flows. In order to modify the contact chamber, hydraulic performance of the prototype and unmodified chambers must be evaluated; areas of poor plug flow performance must be identified; and a series of systematic modifications can then be installed. Graphical presentations of the output response function data are presented; these demonstrated a hydraulic similarity between the model and field chlorine contact chambers. (Kramer-FIRL)
W76-03231

STUDY OF COAGULATION OF WATER BY FLUOROMETRY (ETUDE DE LA COAGULATION DES EAUX PAR FLUOROMETRIE),
Laval Univ., Quebec. Dept. of Civil Engineering.
J-B. Serodes, and A. Soucy.
Revue Canadienne de Genie Civil, Vol 2, No 3, p 253-261, September, 1975.

Descriptors: *Water treatment, Analytical techniques, *Fluorometry, Treatment facilities, *Coagulations, Aluminum, Ions, Hydrolysis, Temperature, *Pollutant identification.
Identifiers: Coagulants, Aluminate ion, Aluminum ion.

A fluorometric method has been used to determine residual aluminum salts used as coagulants in water treatment. With this method, the influence of such factors as temperature on the hydrolysis of these salts may be evaluated. It was found that the yield of hydrolysis was lessened by low temperatures and that aluminum ion is more sensitive than aluminate ion. The method described is suggested for detecting problems in the operation of water treatment plants. (Kramer-FIRL)
W76-03239

MONITORING LAB GIVES CITY THE JUMP ON SAFE DRINKING WATER REGULATIONS,
Inglewood Water Dept., Calif.
K. D. Duke.
The American City and County, Vol 90, No 10, p 70-71, October, 1975.

Descriptors: *Monitoring, *Water quality, *Laboratory tests, *Water treatment, Treatment facilities, Heavy metals, Pollutant identification, Capital costs, Cities, Legislation, Equipment, Personnel, California.

The city of Inglewood, California with a population of 90,000, has developed a complete, well-equipped quality monitoring laboratory. Tests are being conducted on heavy metals, trace pollutants, physical parameters, and bacteria. The laboratory personnel include a full-time chemist, a paid student, and a student being trained under the federal CETA program. A water service inspector also conducts field checking for cross-connections. The capital costs for the laboratory were about $44,000, including casework and equipment purchased over a five year period. For fiscal year 1975-1976, the approved budget was $67,000. The city relies on some ground water sources but mainly on imported water for the Metropolitan Water District of Southern California (MWD). Because of the danger of an earthquake, the community has passed a bond issue to improve its own water system by building new water lines and storage facilities as well as a new water treatment plant. The treatment plant is planned to begin operation in January 1977. The laboratory will play a major role in monitoring the processes involved with the facility. Additionally, when new drinking water regulations come into effect, Inglewood will be responsible for its own water quality and will continue monitoring its wells and treatment facilities. (Kramer-FIRL)
W76-03240

THE PLANNING AND CONSTRUCTION OF POTABLE WATER WORKS IN RELATION TO THEIR OPERATION (EL PROYECTOR Y CONSTRUCCION DE OBRAS DE AGUA POTABLE EN RELACION CON LA OPERACION),
G. Flores-Sousa.
Recursos Hidraulicos, Vol 4, No 2, p 204-213, 1975. 4 fig.

Descriptors: *Water treatment, *Water works, Foreign research, Planning, Construction, Operation, *Mexico, Water supply, Potable water.

The General Direction of the Operation of Potable Water and Sewerage Systems of Mexico feels that there is a need for reviewing the demand, customs, economic possibilities, and standards of operation of water treatment in order to obtain directives, data, and further experience. This information will be used to perform projects and construct water works in a more economical and functional manner to provide for the optimum utilization of the available hydraulic, technical, and financial resources. Rigid standards to be followed in the planning and construction of water works are not desirable. Instead, engineers and technicians in the field of water engineering should conscientiously study the problems and formulate specifications

and instructions applicable to Mexico and other developing countries. The General Direction of the Operation of Potable Water and Sewerage Systems has established a procedure of systematic observation in towns of the Republic with different living conditions, number of inhabitants, climate, type of water supply, and socioeconomic aspects. This information will be made available to designers of new water works and others concerned with the improvement of existing treatment facilities. The information should also identify areas in which operation can be improved and currently used techniques can be modified or adapted. (Orr-FIRL)
W76-03253

STUDY OF FLUORINE IN THE UKRAINE AND THE ENDEMIC FLUOROSIS CONNECTED THEREWITH (IZUCHENIE FTORA NA UKRAINE I SVYAZANNOGO NIM ENDEMICHESKOGO FLYUROZA),
For primary bibliographic entry see Field 5C.
W76-03254

THE METROPOLITAN WATER DISTRICT OF SOUTHERN CALIFORNIA REPORT FOR THE FISCAL YEAR JULY 1, 1973 TO JUNE 30, 1974.
Southern California Metropolitan Water District, Los Angeles.
For primary bibliographic entry see Field 4A.
W76-03285

WATER TREATMENT.
For primary bibliographic entry see Field 4A.
W76-03288

ASPECTS OF WATERWORKS PUMPING PLANT DESIGN,
For primary bibliographic entry see Field 8C.
W76-03324

WATER AUTHORITIES' RESEARCH NEEDS,
For primary bibliographic entry see Field 5D.
W76-03325

REAL OR RASH REGIONALIZATION,
C. H. Capen.
American Water Works Association Journal, Vol 67, No 10, p 588-590, October, 1975. 1 fig, 1 tab, 19 ref.

Descriptors: *Water supply, *Water rates, *Legislation, Administration, Sewers, State jurisdiction, *Regional development, Water treatment.
Identifiers: Water rate manual.

Data on the populations, annual water supply volumes, and revenue for twenty-five large United States cities were compared. A surcharge is generally appled to rates for city water sold to suburban or outside areas, and cities have had difficulties in obtaining their desired compensation. In some cases, a district or regional administration has helped to overcome outmoded legislation. The cases of Philadelphia and Pittsburgh were cited, where a city is not serving water to noncity areas. Other utilities (such as in Louisville and Nashville) have expanded to include both water and sewer operations. The effects of a lack of standards and price-escalation controls has been felt in water rate controversies in New York and Chicago. In New Jersey, state, district, city, and suburban officials have overlapping and conflicting jurisdiction. A new water rate manual for sales and others, including both individual city control and regional or district control is greatly needed. More appropriate legislation for water rates was also recommended. (Kramer-FIRL)
W76-03327

GET THE WATER OUT OF ALUM SLUDGE,
W. S. Foster.
The American City and County, Vol 90, No 9, p 83-85, September, 1975. 3 fig.

Descriptors: *Water treatment, *Sludge treatment, *Dewatering, Coagulation, Filtration, Chlorination, Surface water, Diatomaceous earth, Construction costs, Operating costs, *Treatment facilities, Georgia.
Identifiers: *Pneumatic ejectors, *Alum sludge.

A description was made of Atlanta's new Hemphill Settled Solids Treatment Plant. It represents a new aspect of water treatment necessitated by stricter standards of stream purity. Its processes apply to any system drawing from surface sources and treating the water by coagulation and filtration. This plant uses three clarifier-thickeners designed for a surface overflow rate of 1.75 gpsf/min, although experience indicates that a lower rate is more effective. In chemical feed tanks the sludge pH is raised to permit dewatering which occurs in pressure filters. These utilize diatomaceous earth and produce a cake of 46% solids, which is transported to a landfill area, and a filtrate of less than 10 ppm suspended solids, which is run through a chlorine contact chamber and returned to the plant's raw water reservoirs. Innovative features include sludge transport through pneumatic ejectors, important because the sludge this plant treats is abrasive and damages equipment with any moving parts. This transport system can move sludge of varying consistencies and eliminates spillage. Operating costs may be as much as $30.86/ton solids removal. The EPA contributed 33% of construction costs. For each filter run, 62,000 gallons of water are returned to the plant's reservoirs. A use is being sought for the dewatered sludge. (Beale-FIRL)
W76-03334

DDC PROCESS OF SAIKAWA WATER TREATMENT PLANT IN KANAZAWA CITY,
H. Aoki, and H. Kamei.
Suido Kyokai Zasshi, (Journal of Japan Water Works Association), No 487, p 20-30, 1975. 8 fig.

Descriptors: *Water treatment, *Control systems, *Filtration, *Computers, *Sedimentation, Water purification, Chlorine, Monitoring, *Treatment facilities.
Identifiers: Japan, *DDC system.

The DDC system of the Saikawa water purification plant, Japan, is described. The plant has a maximum treatment capacity of 161 cu km/day with one water basin, three rapid agitating basins, six sedimentation basins, nine high speed filtering basins, one chlorine mixing basin and two water purification basins. Chemicals used for water treatment included chlorine as a disinfectant, PAC as an aggregating agent, and sodium alginate as a co-aggregating agent and alkali. An SPC long distance control system is used for monitoring water piping and the water reservoir while the DDC system is used for monitoring the water purification and water distribution basins. The DDC system consists of a central operation-treatment machine, man-machine communication devices, a detection apparatus and an on-spot control board. The system controls the water level, water quanity and quality, application of chemicals and disinfection, and the automatic operation of machinery. Minor loop control of the process for the DDC system is conducted by PID feedback control. (Su-FIRL)
W76-03339

DEVELOPMENTS IN PUMPING SYSTEM, A TWO YEARLY REVIEW, PUMPING AND THE EMPINGHAM SCHEME.
For primary bibliographic entry see Field 8C.
W76-03340

COMPARATIVE STUDIES ON THE ACTION OF CHLORINE AND OZONE ON POLIOVIRUSES IN THE REPROCESSING OF DRINKING WATER IN ESSEN (VERGLEICHENDE UNTERSUCHUNGEN UEBER DIE WIRKUNG VON CHLOR UND OZON AUF POLIOVIREN BEI DER TRINKWASSERAUFBEREITUNG DER STADT ESSEN),
O. Thraenhart, and E. Kuwert.
Zentralblatt fuer Bakteriologie, Parasitenkunde, Infektionskrankheiten und Hygiene, Abteilung 1: Originale, Reihe B: Hygiene, Praeventive Medizin, Vol 160, No 4/5, p 305-341, 1975. 16 fig, 13 tab, 51 ref.

Descriptors: *Ozone, *Chlorine, *Water treatment, *Potable water, Water supply, Hydrogen ion concentration, Viruses, Sewage, Disinfection, Waste water treatment, Costs.
Identifiers: *Essen(Germany), *Poliovirus, Redox-potential.

In order to decide whether to change the method of potable water supply treatment from chlorine to ozone in Essen, Germany, the comparative inactivation of polio virus type I strains by means of chlorine and ozone were evaluated under laboratory conditions. Polio virus type I was chosen because of its epidemiological behavior and high stability in drinking water and sewage lines. The virus-inactivating effect of specific quantities of disinfectants in water without redox-potential (double-distilled water), water with low defined redox-potential (double-distilled water + KOH), previously chlorinated water with a residual chlorine content of 0.03 mg chlorine per liter (tap water), and water with a high redox-potential (well water from the drinking water plant) were examined. Time course studies were performed, both with chlorine and ozone, to evaluate the characteristics of the inactivation procedure. Results took into account the quantitative differences in effect, and confirmed that chlorine and ozone can be considered equivalent in their action of virus-disinfection. The initial rate and the kinetics of virus disinfection were identical, and the effectiveness of both disinfectants was dependent upon the condition of the water (such as redox-potential, pH) to a water supply in Essen, Germany, could not be drawn on the basis of these virological experiments. That decision must be based on facts such as relative costs and practicability of ozonization on a large technical scale. (Kramer-FIRL)
W76-03345

USE OF REVERSE OSMOSIS AND ULTRAFILTRATION FOR REMOVING MICROORGANISMS FROM WATER,
Army Mobility Equipment Research and Development Center, Fort Belvoir, Va. Sanitary Sciences Div.
J. A. Hinterberger, D. S. Lindsten, and A. Ford.
Available from the National Technical Information Service, Springfield, Va 22161, as AD-A008 331, $5.00 in paper copy, $2.25 in microfiche. Report No 2111, September, 1974. 81 p, 32 fig, 18 tab, 11 ref.

Descriptors: *Water treatment, *Potable water, *Reverse osmosis, Membrane processes, Membranes, Pilot plants, Bacteria, Potomac River.
Identifiers: Ultrafiltration.

An investigation of the efficiency of reverse osmosis (RO) and ultrafiltration to remove bacteria from water in order to produce safe potable water was conducted. Raw polluted Potomac River water and Fort Belvoir, Virginia, tap water enriched with test organisms were used as the test water. Reverse osmosis and ultrafiltration membranes are very effective in removing bacteria from water. RO membranes in full-scale pilot plants initially has a nearly 100% rejection rate which decreased depending on feedwater quality, operating time, and length of shutdown period. Commercial RO membranes are not perfect, and

bacteria can pass through the leaks. The difference in rejection rates of microorganisms between laboratory equipment using membrane disks, and rejection rates of full-scale pilot plant is due to the large difference in membrane area which has a greater risk of leaks. Chlorination of the feedwater so that there is a free chlorine residual in the product water is recommended to counteract or minimize the biological degradation of the cellulose acetate membrane and to suppress bacterial growth on the membrane surface. It is necessary to also post chlorinate the product water. An enrichment of bacteria in technical equipment resulted from long interruptions overnight or on weekends. A combined water purification system of RO and ultrafiltration will achieve an excellent potable water quality. However, the enrichment effect causes breakthrough of microorganisms. In order to make this treatment safe, it is necessary to prevent enrichment. (Orr-FIRL)
W76-03349

THE PROCEEDINGS OF A NATIONAL SYMPOSIUM ON THE STATE OF AMERICA'S DRINKING WATER.
North Carolina Water Resources Research Inst., Raleigh.
September 26-27, 1974, held at University of North Carolina at Chapel Hill, NC, 262 p. Edited by F. Eugene McJunkin, North Carolina State University, Raleigh, NC 27607, $8.00.

Descriptors: Water quality, Public health, *Water supply, *Water treatment, Symposia, Water rates, Legislation, *Enteric bacteria, Viruses, Conferences, *Potable water, Water sources.
Identifiers: *Safe Drinking Water Act, Enteric viruses, Small water supplies, Waterborne diseases.

Drinking water is undoubtedly the first ranking priority in water management; certainly, this is because of health considerations. Yet, drinking water has received too little attention on the national scene outside the realm of professional societies like the American Water Works Association. This symposium was sponsored by Duke University, North Carolina State University, University of North Carolina at Chapel Hill, and the U. S. Environmental Protection Agency for the purpose of increasing the level of understanding of the many aspects associated with insuring safe driking water. Twenty-one presentations are included on the impact of the Safe Drinking Water Act, health relationships of today's water supplies, water supplies for rural areas and small communities, and state of the art of water supply. (See W76-03423 thru W76-03442)
W76-03422

IMPACT OF THE SAFE DRINKING WATER ACT,
Environmental Protection Agency, Washington, D.C. Office of Water Supply.
J. H. McDermott.
In: The State of America's Drinking Water, September 26-27, 1974, Chapel Hill, North Carolina, Research Triangle Universities, p 3-18. 3 tab.

Descriptors: *Potable water, *Legislation, Water quality standards, Water supply, Water treatment, Treatment facilities, Federal jurisdiction, Research.
Identifiers: *Safe Drinking Water Act, Congress.

The Safe Drinking Water Act was signed into law in December, 1974. However, further legislation is being debated because current standards have not been uniformly applied. A reassessment of the current technology is needed, particularly with respect to small systems. Data for the past few years were collected and indicated that many drinking water systems lack adequate collection and treatment facilities, have poorly trained and/or part-time employees, are infrequently inspected by the state or county, and are poorly operated and maintained. Additionally, there is a substantial lack of public awareness of the problems. The drinking water standards were defined in terms of the roles of federal, state, and local utilities. Technical assistance has been given by the federal government for research related to the 'cause, diagnosis, treatment, control, and prevention of physical and mental disease' of man, and to providing a dependable safe drinking water supply. Pending legislation both in the Senate and in the House was discussed. It was noted that the House bill would authorize treatment standards in cases where lack of measurement techniques and/or firm health effects data would otherwise prevent the establishment and enforcement of a constituent standard. It was concluded that the most immediate legislative challenge is to extend or modify existing practices for application in small systems. In addition, it was hoped that the research conducted under the Safe Drinking Water Act will improve the quality and dependability of United States water supplies. (See also W76-03422) (Kramer-FIRL)
W76-03423

THE DEVELOPMENT AND APPLICATION OF THE 1974 DRINKING WATER STANDARDS,
Environmental Protection Agency, Washington, D.C. Office of Water Supply.
R. D. Lee.
In: The State of America's Drinking Water, September 26-27, 1974, Chapel Hill, North Carolina, Research Triangle Universities, p 19-33. 1 tab, 4 ref.

Descriptors: *Potable water, *Legislation, *Public health, *Water quality standards, Water supply, Water treatment, Water pollution effects, Monitoring, Pollutant identification, Turbidity, Mercury.

Provisions of the 1972 Safe Drinking Water Standards were discussed, viewing the act as a revision of the 1962 Public Health Service Drinking Water Standards. The proposed new standards with the greatest impact on water supply utilities and regulatory agencies were said to be: the reduction of the turbidity limit from 5 units to one unit and its reclassification as a health-related constituent; the addition of a mercury standard of 2 micrograms per liter; the addition of several pesticides for which monitoring will be required; and, the concept of radiation dose to replace the previous concentration of radioactivity in water. A more detailed list of changes in the new standards is provided in tabular form. Changes were made in standards for bacteria, chlorine residual, viruses, trace substances, and radioactive substances. The impact of the new standards and guidelines on water utilities is dependent upon procedures for surveillance and monitoring as defined by the individual states. The Standards emphasize the continuing need to evaluate alternative sources and to choose those which present the minimum risk of contamination by waste waters with impurities which might be a health hazard. Over a seven year period, analyses of all of the 240,000 water systems (40,000 conventional and 200,000 which serve the travelling public) in the United States are planned. Additional research on health effects and treatment technology is needed before standards can be developed that can adequately protect human health on a long range basis. (See also W76-03422) (Kramer-FIRL)
W76-03424

NEW ENVIRONMENTAL HEALTH PROBLEMS IN WATER SUPPLY,
National Inst. of Environmental Health Services, Research Triangle Park, N.C.
D. P. Rall.
In: The State of America's Drinking Water, September 26-27, 1974, Chapel Hill, North Carolina, Research Triangle Universities, p 34-37.

Descriptors: *Chemical industry, *Toxicity, *Public health, *Environmental effects, *Potable water, Pollutant identification, Analytical techniques.

The possible toxic effects of newly produced chemicals on public health, when introduced into public water supplies, are of great concern. Because between 500 and 1,000 new chemicals are introduced into commerce each year, the potential harm of these has not been measurable. Because there is no systematic mechanism for knowing the processes by which these new chemicals are produced, it cannot be predicted when intermediates and by-products will appear in the environment. Two well-known examples of this are polychlorinated biphenyls, which were accidently discovered in carcasses of birds, and phthalic acid esters, which also appeared suddenly in the environment. Thus, the first major problem was defined as the need to develop systematic mechanisms to monitor the production of new and old chemicals, including knowledge about chemical identity, production volumes, processes intended uses, and by-products. Simple, rapid presumptive toxicity tests must be designed to estimate their toxicity, with more detailed testing for the chemicals which appear to be most hazardous. Finally, the meaning for human health of the toxicity tests must be understood, and quantitative dosages must be better defined. (See also W76-03422) (Kramer-FIRL)
W76-03425

EPIDEMIOLOGY OF WATERBORNE DISEASE IN THE UNITED STATES 1971-1973,
Center for Disease Control, Atlanta, Ga. Bureau of Epidemiology.
J. M. Hughes, M. H. Merson, and G. F. Craun.
In: The State of America's Drinking Water, September 26-27, 1974, Chapel Hill, North Carolina, Research Triangle Universities, p 38-55. 4 fig, 7 tab, 30 ref.

Descriptors: *Public health, *Pollutant identification, *Epidemiology, *Water pollution effects, *Human diseases, Toxicity, Water supply, Water delivery, Shigella, Salmonella.
Identifiers: *Sewage poisoning, *Center for Disease Control, *Hepatitis, *Typhoid, Arsenic toxicity, Waterborne diseases.

Because waterborne diseases in the United States must be recognized and investigated before they are officially reported to the Center for Disease Control (CDC) or to the EPA, true incidences are difficult to estimate. However, between 1971 and 1973 the reported number of such outbreaks had increased to an average of 24 per year. Waterborne outbreak was defined as the occurrence of illness in two or more persons after drinking water which is implicated epidemiologically as the vehicle of transmission of the illness. Tables were provided on the types (sewage poisoning, Hepatitis A, Shigellosis, Giardiasis, Chemical poisoning, Typhoid fever, and Salmonellosis, in order of decreasing frequency) of outbreaks and the number of cases for 1971, 1972, and 1973. Water systems were classified as municipal, semi-public, and individual. Types of deficiencies found to cause disease in these systems included untreated surface water; untreated groundwater; treatment deficiencies; and deficiencies in the distribution system. A large proportion of the outbreaks occurred in semi-public systems, particularly in summer recreational areas. Case studies for five outbreaks were reviewed. These involved: typhoid in a Florida migrant labor camp; Shigellosis in a Stockport, Iowa, school; Hepatitis at a rural school in Alabama; arsenic toxicity in a Minnesota well; and Shigellosis on a Caribbean cruise ship. To decrease the incidence of waterborne disease it is recommended that local, state, and federal agencies establish effective monitoring and maintenance systems for municipal and semi-public systems and that future outbreaks be reported. (See also W76-03422) (Kramer-FIRL)
W76-03426

ENTERIC VIRUSES AND DRINKING WATER SUPPLIES,
North Carolina Univ. at Chapel Hill. Dept. of Environmental Sciences and Engineering.
M. D. Sobsey.
In: The State of America's Drinking Water, September 26-27, 1974, Chapel Hill, North Carolina, Research Triangle Universities, p 56-70. 1 tab, 45 ref.

Descriptors: *Epidemiology, *Viruses, *Potable water, Sewerage, Distribution systems, Water treatment, Laboratory tests, Public health, Water pollution effects, Analytical tedchniques, Human diseases, Water sampling.
Identifiers: Hepatitis, Enteric viruses.

Very little quantitative information is available on enteric virus levels in United States drinking water, although it is known that these viruses are present in sewage and sewage-contaminated natural waters. Enteric viruses have also been isolated from public water supplies in France and South Africa. Documentation on the epidemiology of waterborne transmission of enteric virus disease has been limited to outbreaks of hepatitis type A. These outbreaks usually resulted from inadequate treatment of private or semi-private supplies or from contamination in the distribution systems of public supplies. Because of the inadequate recognition and reporting of viral disease, it is difficult to recognize whether other waterborne disease outbreaks might have been due to enteric viruses. Both laboratory and field studies have demonstrated that a conventional sewage treatment system with primary and secondary treatment plus effluent chlorination will not reduce the enteric virus concentration by more than about 99%. Various types of water treatment--chemical coagulation, and flocculation, water softening precipitation, rapid sand filtration, chlorination, or ozone--will produce a reduction in virus concentration of 6 to 7 orders of magnitude. Detection methods have been developed which may be used to determine small amounts of viruses in up to 100-gal volumes of drinking water. These methods include flow-through filter adsorption-elution systems and ultrafiltration. Enteric virus drinking water standards have not yet been set, and surveillance studies are recommended to determine if current microbial standards are adequate to protect the public health. (See also W76-03422) (Kramer-FIRL)
W76-03427

ORGANIC CHEMICALS IN DRINKING WATER,
California State Dept. of Health, Berkeley. Water Sanitation Section.
D. P. Spath, and H. J. Ongerth.
In: The State of America's Drinking Water, September 26-27, 1974, Chapel Hill, North Carolina, Research Triangle Universities, p 71-79, 14 ref.

Descriptors: *Recycling, *Water reuse, *Waste disposal, *California, *Public health, Water supply, Organic compounds, Reclamation, Sewage disposal, Sewerage, Environmental effects, *Organic wastes, *Chemical wastes.
Identifiers: Waste water reuse.

Planned reuse of waste waters has increased, particularly in California where waste water reclamation includes crop irrigation, landscape-golf course irrigation, industrial water supply, recreational impoundments, and groundwater recharge. California encourages waste water reuse where there is no hazard presented to the public health. However, much concern has been expressed because of the lack of information about the risks of chronic illness from long-term exposure to residual organics that remain in treated waste water. The toxicity of residual organic chemicals has been measured in laboratory animals, but extrapolations to humans are difficult and uncertain. Plans to use renovated waste water to augment domestic sources as well as proposals for using renovated waste water for industrial purposes are described. Both direct and indirect waste water reuses imply a burden of responsibility. The identity of organic residues in renovated sewage has not been completely established. Further emphasis should be placed on determining organic constituents and identifying health effects, and caution has been urged in future waste water reuse. (See also W76-03422) (Kramer-FIRL)
W76-03428

OVERVIEW OF PROBLEMS ASSOCIATED WITH INORGANIC CONTAMINANTS IN DRINKING WATER,
Environmental Protection Agency, Cincinnati, Ohio.
G. F. Craun, and L. J. McCabe.
In: The State of America's Drinking Water, September 26-27, 1974, Chapel Hill, North Carolina, Research Triangle Universities, p 80-98, 3 tab, 37 ref.

Descriptors: *Potable water, *Human disease, *Metals, *Inorganic compounds, Water treatment, Hardness(Water), Water pollution effects.
Identifiers: Water piping, Cardiovascular diseases.

An overview of problems, both acute and chronic, associated with inorganic drinking water contamination is presented. Between 1946 and 1972, 19 outbreaks and 279 cases of waterborne illness were reported due to chemical poisoning. While this represents only 3% of the total waterborne disease outbreaks documented for this period, the mortality rate was 3.4% (compared to 0.05% for all waterborne illness). These poisonings involved fluoride, selenium, arsenic, and copper. Such statistics are useful for implementing prevention measures. However, greater concern has been expressed on the effects of low-levels of contaminants in drinking water on chronic disease mortality. Contradictory results have been obtained from several studies correlating cardiovascular diseases and the mineralization (hardness or softness) of drinking water supplies. Soft water is generally more corrosive and may contain more metal contaminants from water piping; however, hard water contains larger amounts of calcium and magnesium. Extensive research on water quality and cardiovascular disease is on-going. The sources of metals in drinking water have been investigated and distribution sampling for water supplies in Boston and Seattle are illustrated in tabular form. Mutagenic and carcinogenic effects were also postulated, and research on the removal of trace inorganic substances by water treatment processes is being conducted. (See also W76-03422) (Kramer-FIRL)
W76-03429

EVALUATING STATE DRINKING WATER QUALITY SURVEILLANCE PROGRAMS,
Environmental Protection Agency, Atlanta, Ga. Region IV.
D. H. Taylor, and G. D. Hutchinson.
In: The State of America's Drinking Water, September 26-27, 1974, Chapel Hill, North Carolina, Research Triangle Universities, p 99-116. 3 fig, 5 tab, 10 ref, 1 append.

Descriptors: *Water supply, *Public health, *Standards, *Legislation, *Potable water, *Water quality, Sampling, Kentucky, Georgia, Tennessee, Personnel, Water treatment.

The results of studies in four southeastern states on water supply conditions have been summarized. Data were provided for Kentucky, Georgia, Tennessee, and a fourth state whose name has not yet been released. The evaluation included a review of basic water supply statutes, regulations, and program policies. The activities, responsiveness to problems, personnel, and management were examined. The three general types of water supply systems were public water supply, small public water systems (serving non-resident public or fewer than the minimum resident requirement), and primate, single family systems. Public and semi-public water supplies were evaluated for failures to meet bacterial standards, recommended chemical standards, and mandatory chemical standards. Public water supplies were also rated on their failure to fluoridate at correct levels. Other surveillances included bacterial sampling, chemical sampling, cross connection programs, and the existence or lack of annual State Agency inspection. Percentages of supplies having each characteristic were shown in three tables. Overall, water supply practice was found deficient in all four states, in terms of bacterial and chemical standards, treatment and storage facilities, and operator-training. It was suggested that State legislatures need to make greater commitments to the water supply industry to expand margins of safety in water quality and supply. (See also W76-03422) (Kramer-FIRL)
W76-03430

STRATEGIES FOR ASSURING HIGH QUALITY DRINKING WATER IN THE FUTURE,
North Carolina Univ. at Chapel Hill. Dept. of Environmental Engineering.
D. A. Okun.
In: The State of America's Drinking Water, September 26 and 27, 1974, Chapel Hill, North Carolina, Research Triangle Universities, p 117-123.

Descriptors: *Potable water, *Water supply, *Regional development, Legislation, Treatment facilities, Construction costs, Water treatment, Personnel, Administration.
Identifiers: Regional Water Authorities System(Great Britain).

Based on findings of several recent surveys, the smaller, private water supply systems in the United States do not have adequate resources in terms of facilities, manpower, or funds to provide high quality service. The United States' problems are of a larger scale than Great Britain; however, recent reorganization in England was cited as a valuable comparison. The new (since April, 1974) Regional Water Authorities System in Britain was described in detail. It was conceded that in the United States, particularly in smaller communities, the quality of waste water treatment facilities operation has not matched investments. In addition, 75% of the construction costs of municipal interceptors and treatment works are met by federal grants, with state governments adding 10 to 15%. Thus, local governments have been reluctant to initiate projects until they are assured grant support. The construction grant program covers only capital costs, thus promoting facilities that maximize construction costs and minimize operating costs, rather than optimizing design. Other problems include the requirement for uniform treatment, disregarding local needs. With the diversity of United States' water supplies, integrated regional management is highly urged. (See also W76-03422) (Kramer-FIRL)
W76-03431

PROBLEMS IN SMALL WATER SYSTEMS,
North Carolina Dept. of Human Resources, Raleigh. Div. of Health Services.
C. E. Rundgren.
In: The State of America's Drinking Water, September 26-27, 1974, Chapel Hill, North Carolina, Research Triangle Universities, p 124-134. 2 fig.

Descriptors: *Water supply, *North Carolina, *Costs, Construction, Planning, Engineering, Management, Personnel, Water quality control, Wells, Legislation.
Identifiers: North Carolina Clean Water Bond Act.

Problems of small water supply systems were discussed, with a focus on North Carolina systems. Three types of problems were evaluated: financing, planning, and operation, maintenance,

and management. Financial problems centered around funding of expansion and improvement rather than initial construction. Approaches in North Carolina to solve financing included a Farmers Home Administration program for non-profit water associations. Other alternatives were the sale of a water system to the governmental system or to a privately owned public utility, thus reducing the number of smaller systems. Problems of inadequate planning comprised: improper well site location; inadequate storage capacity; supply capacity source inadequate for demand; distribution pipeline too small; and lack of water quality control provision. Proper development, engineering consultation, and the meeting of 1972 design, construction, and disinfection standards was recommended. Problems of operation, maintenance, and management related to the lack of experience and/or trained personnel, funds for depreciation and expansion, and laboratories for water quality control. While no solutions were available for privately owned water systems, the North Carolina Clean Water Bond Act of 1971 provided funds for municipal water systems. Benefits of partially completed projects under this Act were described. (See also W76-03422) (Kramer-FIRL)
W76-03432

FINANCIAL CONSIDERATIONS FOR RURAL WATER SYSTEMS,
Farmers Home Administration, Washington, D.C.
C. W. Rose.
In: The State of America's Drinking Water, September 26-27, 1974, Chapel Hill, North Carolina, Research Triangle Universities, p 135-142.

Descriptors: *Construction costs, *Rural areas, *Water supply, Design criteria, North Dakota, Iowa, Oklahoma, South Dakota.
Identifiers: Water storage, Overdesign.

The Farmers Home Administration (FmHA) has actively been involved in the design and financing of rural water systems for several years. Engineers in the FmHA found it nearly impossible for small isolated communities to meet the rigid standards of urban areas in terms of fire protection, storage capacity, or reserve flows. Successful FmHA systems in North Dakota, Iowa, Oklahoma, and South Dakota were described. These systems recognized potential uses of new construction materials, such as plastic pipes, multimedia filters, and hydropneumatic pressure systems. Because of increasing construction costs, it recommended that rural areas re-evaluate flow calculations and unworkable design guides, with particular emphasis on avoiding unnecessary overdesign. (See also W76-03422) (Kramer-FIRL)
W76-03433

PROBLEMS OF INDIVIDUAL SUPPLIES,
Environmental Protection Agency, Washington, D.C. Office of Water Supply.
W. J. Whitsell, G. D. Hutchinson, and D. H. Taylor.
In: The State of America's Drinking Water, September 26-27, 1974, Chapel Hill, North Carolina, Research Triangle Universities, p 143-157. 5 fig, 20 ref.

Descriptors: *Water supply, *Potable water, *Water quality standards, Georgia, Tennessee, Kentucky, Wells, Coliforms, Water pollution sources.
Identifiers: Individual water supplies.

The EPA has estimated that 50 million people in the United States depend upon individual water supply systems. It was also estimated that about 40% of these supplies do not meet safety standards. Studies in Georgia, Tennessee, and Kentucky were conducted; results of coliform tests were illustrated in five graphs. The most common deficiencies, as determined from these studies and other field data were insufficient and substandard well casing, inadequate formation seal between the well casing and bore hole, poor welding of casing joints and indiscriminate perforation of casing, lack of sanitary well covers, reliance on a dug well, and use of well pits to protect from freezing. For safe individual home water supplies, a list of well construction and recommendations was prepared. It included: the construction of wells by drilling, driving, or jetting; use of schedule 40 or heavier steel casing and water-tight welded or threaded-and-coupled joints; installation of solid casing, at least 5 feet below the lowest anticipated static water level; filling of the annular case between the bore hole and casing with a suitable sealant; minimum grouting thickness of the annual space deeper than the deepest frost penetration, sealing out water, of 1 1/2 inches; and proper covering and ventilation. (See also W76-03422) (Kramer-FIRL)
W76-03434

LEGAL CONTROLS FOR PROTECTING UNDERGROUND SOURCES OF DRINKING WATER,
Virginia Polytechnic Inst. and State Univ., Blacksburg. Water Resources Research Center.
W. R. Walker, and W. E. Cox.
In: The State of America's Drinking Water, September 26-27, 1974, Chapel Hill, North Carolina, Research Triangle Universities, p 158-167. 34 ref.

Descriptors: *Legislation, *Groundwater, *Water pollution sources, *Waste disposal, Water supply, Potable water, Land use, Injection wells, Drainage wells, Water quality control.

Proposed legislation, particularly the House of Representatives bill H. R. 13002, emphasizes groundwater as a source of water supply. Passage of this legislation would improve the existing situation by providing federal regulation of state underground injection control programs. However, even adoption of this bill would leave separate policy provisions for gravity flow drainage wells, as opposed to injection wells. Other sources of groundwater contamination, such as surface activities, would remain unregulated under the proposed law. Legal controls currently in effect were reviewed. It was noted that there is no comprehensive program for control of underground sources of drinking water and that basic authority may best be established at the state level. It was also suggested that the scope of necessary controls may have to be expanded to include land use in addition to the restrictions on waste disposal. (See also W76-03422) (Kramer-FIRL)
W76-03435

EMERGENCY SUPPLIES,
Environmental Protection Agency, Washington, D.C. Office of Water Supply.
F. A. Bell, Jr.
In: The State of America's Drinking Water, September 26-27, 1974, Chapel Hill, North Carolina, Research Triangle Universities, p 168-177. 1 tab, 7 ref.

Descriptors: *Water shortage, *Water supply, *Earthquakes, California, Water treatment, Distribution systems.
Identifiers: *Emergency water supply, Nicaragua, Urban areas.

Problems of emergency water supplies were examined. Two actual case studies and one hypothetical example resulting from earthquake disasters in urban areas were detailed. No major problems occurred in providing the population of 14,000 with emergency water in San Fernando, California, in February, 1971. In a Managua, Nicaragua earthquake in December, 1972, however, there were 100,000 persons affected. Their program of tank truck water deliveries was effective in sustaining life but was slow and entailed problems of availability and safe water treatment. A hypothetical earthquake of the Hayward Fault (San Francisco Bay, California) would ruin a water supply system serving over one million people. Problems would be in distribution, rather than treatment or availability of water. Practical steps were outlined for federal, state, and local governmental preventive measures. These included: assessing available alternative water supplies; taking inventory of possible sources of trucks to carry emergency water; and establishing mutual aid agreements with nearby utilities. (See also W76-03422) (Kramer-FIRL)
W76-03436

AN APPROACH TO PROVISION OF RURAL WATER SUPPLIES,
Conset, Inc., Washington, D.C. National Demonstration Water Project.
S. S. Zimmerman.
In: The State of America's Drinking Water, September 26-27, 1974, Chapel Hill, North Carolina, Research Triangle Universities, p 178-189. 1 tab.

Descriptors: *Water supply, *Rural areas, *Sewers, Virginia, West Virginia, South Carolina, Arkansas, New Mexico, Florida, Management, Regional development, Publications.

The National Demonstration Water Project (NDWP) was organized in 1971 and was initially funded by the Office of Economic Opportunity. Its original goal was to bring adequate water facilities to the five rural counties surrounding Roanoke, Virginia. By 1973, the project had grown to include six affiliate projects, from Florida to New Mexico. The basic goals of the NDWP are: to build over $30 million worth of facilities by 1980, through the six affiliates; to design and test models for rural water and sewer projects; to gain technical and non-technical expertise for the development of such projects; and to organize a national alliance to continue improving rural water and sewer facilities after the NDWP program is over. Problems of financing, operation, maintenance, and regulation in rural systems were detailed. The present methodology of the NDWP program involves three types of field approaches. The affiliate projects (in West Virginia, Virginia, South Carolina, Arkansas, New Mexico, Florida) are all in low-income rural areas. The Virginia and New Mexico project are non-profit, run by user-owned water-sewer companies. The West Virginia, South Carolina, and Arkansas projects were also developed by non-profit companies, but are managed by public agencies. The Florida project was developed by a cooperative-controlled non-profit agency, and is supported by a rural electric cooperative. On the national level, the NDWP coordinates the various affiliate projects and conducts research for publications on state and federal policies and on rural water sewer development practices. (See also W76-03422) (Kramer-FIRL)
W76-03437

DESIGN OF WATER TREATMENT FACILITIES,
Camp, Dresser and McKee, Inc., Boston, Mass.
P. W. Prendiville.
In: The State of America's Drinking Water, September 26-27, 1974, Chapel Hill, North Carolina, Research Triangle Universities, p 190-198.

Descriptors: *Water treatment, *Pilot plants, *Treatment facilities, *Design criteria, Control systems, Automation, Computers, Economics.

A brief overview was presented of currently used methods in the water treatment processes. Topics included: pilot scale investigations; flexibility in design; flocculation and chemical coagulants; sedimentation; filtration; instrumentation and control of the processes; and sludge and waste water treatment and disposal. An emphasis was made on the choice and application of chemicals and the design of the flocculation, sedimentation, and filtration processes. The use of direct filtration and

economic advantages of that method for the treatment of some water supplies was also discussed. The use of pilot plants before building treatment facilities was strongly urged, particularly for filtration rates, degree of flocculation, and the choice of chemical applications. To allow for future plant expansion, a recommendation was made that design be flexible. Decisions of when to automate water treatment facilities were considered, particularly for the filtration process, chemical processes, and hydraulic flow-through. In larger plants, the logging of data, control loops, and maintenance programs may also be computerized. In considering the waste treatment plant, the disposal of solids was seen as a major design problem. (See also W76-03422) (Kramer-FIRL)
W76-03438

WATER RATES: AN ASSESSMENT OF CURRENT ISSUES,
Johns Hopkins Univ., Baltimore, Md.
S. H. Hanke.
In: The State of America's Drinking Water, September 26-27, 1974, Chapel Hill, North Carolina, Research Triangle Universities, p 199-218. 2 fig, 18 ref.

Descriptors: *Costs, *Water demand, *Water rates, Economics, Computers, Model studies, Marginal costs, Water supply, Environmental effects, Water consumption, Cost allocation.

Rate-making policies for water utilities in the urban United States were assessed. Changes have developed, from flat rates to metered rates, with a declining block structure (the first blocks of water consumed during a billing period are purchased at a given rate, with successive larger blocks costing less). This declining block structure is being gradually eliminated and utilities are considering a change to a seasonal rate structure system, whereby rates would be higher in seasons of high cost, high use. The theory of marginal cost pricing was described. It was argued that there are several defects in the actual design of pricing policies, and that historical average costs that are used are not marginal or incremental. Rate-making policies were also criticized for using variable costs not correlated with the demand for either capacity or water. Important new trends in rate-making included computer simulation models to evaluate rate structures and their impact on water use, sewer flows, costs, revenues, and required investment. New changes in rate structures were attributed to a compromise between industry and economists' views as well as to environmental regulation. (See also W76-03422) (Kramer-FIRL)
W76-03439

TRAINING OPPORTUNITIES AND THE SAFE DRINKING WATER ACT,
Greensboro Public Works, N.C.
R. E. Shaw, Jr.
In: The State of America's Drinking Water, September 26-27, 1974, Chapel Hill, North Carolina, Research Triangle Universities, p 219-223.

Descriptors: *Personnel, *Training, *Professional personnel, *Water rates, Water treatment, Water pollution control, Publications.
Identifiers: Public relations, Emergency water planning.

The various developments in the training of operators, chemists, clerical personnel, maintenance personnel, utility engineers, and managers in the water treatment profession were described. The American Water Works Association (AWWA) Education Program, which has been on-going for six years, has been very successful. One AWWA course in Emergency Planning for water utility management included disaster effects, vulnerability assessment, protection measures, and emergency operations planning. Another AWWA seminar on accident prevention has incorporated OSHA requirements and methods to set up an effective program within the utility. One-day seminars have been held since 1973, including the topics of: developing water rates; OSHA compliance and accident prevention; upgrading existing water treatment plants; enhancement and control of reservoir water; and public information/public relations. A project was funded by HEW for the Oklahoma Research Foundation to obtain data in order to provide model job descriptions, performance standards, work-load indicators, and staffing guides. Other developments include the revision of the Water Supply Visual Aids Index and the compilation of the Water Utility Training Directory. AWWA training manuals and materials have increased in circulation and a section of these publications are being translated and printed for distribution in foreign countries, beginning with a program in Brazil. (See also W76-03422) (Kramer-FIRL)
W76-03440

MATHEMATICAL OPTIMIZATION OF WATER SUPPLY SYSTEMS STATE OF THE ART,
Michigan Univ., Ann Arbor. School of Public Health.
R. A. Deininger.
In: The State of America's Drinking Water, September 26-27, 1974, Chapel Hill, North Carolina, Research Triangle Universities, p 224-234. 100 ref.

Descriptors: *Reviews, *Model studies, *Computer models, Mathematical models, Linear programming, Simulation analysis, Water supply, Systems analysis, Treatment facilities, Water treatment, Decision making, Bibliographies, Optimization.

A state-of-the-art review is presented on the tools and techniques available to the systems analyst for solving water supply problems. An extensive bibliography is presented, divided into: general water supply network references; design of well fields; water distribution systems; and models of treatment plants (staging). By using mathematical models and optimization techniques, such as linear programming, more alternatives may be analyzed at each level of decision making, and assumptions or estimations of the influence of economic, political, and environmental uncertainties may be tested. Such techniques also provide a communications tool for professionals involved in water supply planning. The basic steps of a system analysis are outlined. Types of techniques used are: linear programming; nonlinear programming; dynamic programming; integer programming; stochastic programming; geometric programming; network techniques PERT/CPM; simulation techniques; and classical optimization techniques. Although any one of these mathematical modeling and computational techniques increases the capability of generating information to be used in the decision-making process, it was emphasized that these are only tools, and cannot by themselves solve water supply systems problems. Additionally, one must be careful in applying model solutions to real situations. (See also W76-03422) (Kramer-FIRL)
W76-03441

WATER DEMAND FORECASTING--SOME CONCEPTS AND TECHNIQUES,
North Carolina Univ., Chapel Hill. Dept. of Environmental Sciences and Engineering.
D. T. Lauria.
In: The State of America's Drinking Water, September 26-27, 1974, Chapel Hill, North Carolina, Research Triangle Universities, p 235-258, 8 fig, 20 ref.

Descriptors: *Forecasting, *Water demand, *Model studies, Mathematical models, Economics, Potable water, Water supply.

Three categories may be used to forecast water demand: locational classification; consumptive use; or usage classification (purpose for which the water is demanded). The third of these is the most commonly used basis for forecasting. Such purposes include irrigation, cooling, commercial supply, residential supply, street washing, and fire protection. The classic economic theory of demand was presented. This theory identifies the basic variables underlying demand, including social tastes and preferences. Most predictions, however, are based on future requirements or needs rather than demand. Three methods used--time series models, regression models, and input/output models--were outlined. It was concluded that the combination of economic theory and mathematical modeling will help investigators to understand and quantify fairly accurately the water demand phenomenon. However, most theory deals with static situations, and more time series analyses and projections of trends are necessary for future estimates. (See also W76-03422) (Kramer-FIRL)
W76-03442

ACTIVATED CARBON: OLD SOLUTION TO OLD PROBLEM, PART II,
A. D. Adams.
Water and Sewage Works, Vol 122, No 9, p 78-80, September, 1975. 4 fig, 1 tab, 24 ref.

Descriptors: *Activated carbon, *Adsorption, *Water treatment, Anaerobic conditions, Sedimentation, Sludge treatment, Dewatering, Operating costs, Anaerobic digestion, *Waste water treatment.

The use of lignite powdered activated carbons in anaerobic digesters, due to the carbons' properties of density and activity, is proposed. Carbon aids in settling supernatant solids so that fewer fine, poor-settling solids are returned to the hydraulic processing section of the plant. Powdered carbon also adsorbs grease and scum that might clog digesters and interfere with mixing. By adsorption, carbon also removes detergents which could interfere with dewaterability of the digested sludge. While the addition of carbon initially increases operating costs, it settles biological solids, clears supernatants, removes odors, and thickens sludge. Digesters containing activated carbon are less susceptible to upsets than conventional systems, and adsorb inhibitory substances that could be toxic to the anaerobic bacteria. Costs over time are reduced because there is less need for dewatering chemicals, deodorant chemicals, chlorine, and supplementary fuel oil. A graphic representation is provided of the time required for an anaerobic system to respond to activated carbon addition. Within two months, supernatants should clear, as carbon becomes incorporated in the biofloc. By four months, gas production should increase and sludge solids should decline. Within six to eight months, the daily carbon dose will be reduced because less sludge is being withdrawn from the digester and operating costs will be lowered accordingly. (Kramer-FIRL)
W76-03443

5G. Water Quality Control

FORAMINOUS COMPOSITION FOR REMOVAL OF OLEOPHILIC MATERIAL FROM THE SURFACE OF WATER,
Sorbent Sciences Corp., Covina, Calif. (Assignee).
J. Orban, and C. E. Case.
U S Patent No 3,917,528, 6 p, 3 tab, 7 ref; Official Gazette of the United States Patent Office, Vol 940, No 1, p 381, November 4, 1975.

Descriptors: *Patents, *Oil pollution, *Water pollution control, *Sorption, *Absorption, *Separation techniques.
Identifiers: Drying oil.

A foraminous substrate which is impregnated with a drying oil is used to rapidly sorb oleophilic or

crude oil from a body of water. To prepare the foraminous substrate, it is suspended in a bath containing a drying oil for at least 0.5 minutes. Then it is removed and excess drying oil is removed by passing the material between mechanical rollers. The foraminous substrate treated with drying oil sorbs substantially more crude oil than other compositions that do not contain the drying oil. Examples of the drying oils are: caster oil, grape seed oil, hemp oil, linseed oil, safflower oil, etc. It is believed the drying oil coats the walls of the cells of the foraminous material to form a continuous hydrophobic-oleophilic barrier which prevents water from being sorbed. (Sinha-OEIS)
W76-03012

HARVESTING AS A CONTROL FOR AQUATIC PLANTS,
Wisconsin Univ. Extension, Madison.
S. Nichols, and G. Cottam.
Water Resources Bulletin, American Water Resources Association, Vol 8, No 6, p 1205-1210, December 1972. 1 fig, 4 tab, 5 ref. OWRT B-019-W15(5).

Descriptors: *Aquatic plants, *Harvesting of algae, Effects, *Lakes, Eutrophication, Control, Management, Aquatic environment, Biomass.
Identifiers: Lake Mendota(Wis), Macrophytes.

An excellent example of lakes that suffer from increased eutrophication as a result of their location in a heavily populated and fertilized urban and agricultural area is that of the lakes in the Madison, Wisconsin area. The accelerated plant growth, along with the invasion of the Eurasian water milfoil, has created problems by greatly restricting the use of these lakes, which are under varied and increasing recreational pressures. Such situations necessitate effective control and management procedures. This paper presents the results of a study of the effects of harvesting on hydrophytes in Lake Mendota, Wisconsin. Results show that one harvest reduced growth by at least 50%, two harvests reduced it by 75%, and three harvests virtually eliminated plant material for the year. The studies also indicate that harvesting one year reduced the biomass the following year, especially in deep water. Three harvests during the previous year were most effective in controlling biomass the second year. To conclude, harvesting does control aquatic plants; the types of control provided can be used in a selective management program that will be beneficial to a wide variety of users. (Bell-Cornell)
W76-03058

ECOLOGY, ECONOMY AND MINING IN VERMONT,
D. Tillman.
Pit and Quarry, Vol 66, No 8, p 66-68, February, 1974. 4 fig.

Descriptors: *Water pollution control, Waste water treatment, *Industrial wastes, *Mining, *Vermont, Lagoons, Environmental effects, Environmental engineering.

Harmonious coexistence of environmental and industrial concerns are demonstrated by the state of Vermont. Mining is a highly significant industry in the state; asbestos production ranks second, and talc extraction and processing ranks third in the nation. Ground calcite, coarser limestone, sand, and gravel are also important economically. At the same time, the state of Vermont is a pioneer in environmental legislation and protection. The mutual cooperation and concern which led to this desirable status is demonstrated by Windsor Minerals, one of the nation's top ten producers of talc products. Windsor operates four mines and two processing plants. Elimination of water pollution at its major processing plant was achieved by pumping water into a series of lagoons, and decanting inert impurities. Eighty percent of the water is recovered. Tailings ponds, when filled, are revegetated. Another illustrative case is the White Pigment Corporation which operates calcite grinding plants. Aesthetic considerations are also important to much of the mining industry. The head frame and ore bin of Windsor Minerals' largest mine has the appearance of a New England barn, while the office structure of the processing plant is designed as a colonial house set on a hill with natural plantings. Tree screens and plantings characterize the entire operation and minimize visual effects of loading areas and machinery. Nearly 10% of the total plant investment for Vermont's mineral community goes towards environmental protection. (Murphy-FIRL)
W76-03061

A LABORATORY INVESTIGATION OF THE EFFECT OF SURFACE FILMS ON WIND INDUCED REAERATION,
Massachusetts Univ., Amherst. Water Resources Research Center.
For primary bibliographic entry see Field 5B.
W76-03100

A NUMERICAL MODEL OF DROPLET ENTRAINMENT FROM A CONTAINED OIL SLICK,
Mount Auburn Research Associates, Inc., Newton Upper Falls, Mass.
For primary bibliographic entry see Field 5B.
W76-03102

ATMOSPHERIC REAERATION IN A RIVER USING PRODUCTIVITY ANALYSIS,
Virginia Univ., Charlottesville.
G. M. Hornberger, and M. G. Kelly.
Journal of the Environmental Engineering Division, American Society of Civil Engineers, Vol 101, No EE5, Proceedings Paper 11644, p 729-738, October 1975. 2 fig, 1 tab, 17 ref, 2 append.

Descriptors: *Reaeration, *Air-water interfaces, *Aeration, *Productivity, *Dissolved oxygen, *Environmental engineering, *Virginia, Respiration, Streams, Rivers, On-site investigation.
Identifiers: *Mechums River(Va), *Parameters.

Two new methods for estimating the reaeration coefficient in rivers were developed. The methods use measurements of dissolved oxygen and incident radiation with a solution to the oxygen mass balance equation. Parameters are estimated by minimizing the squared error between predicted and observed oxygen values. Night-time values of dissolved oxygen can be used to estimate the reaeration coefficient provided respiration is nearly constant. The coefficient can also be estimated by comparing net productivity with incident radiation. Field studies showed the two methods to be reliable. (Lardner-ISWS)
W76-03115

SPARTINA REVEGETATION ON DREDGE SPOIL IN SE MARSHES,
Skidaway Inst. of Oceanography, Savannah, Ga.
W. M. Dunstan, G. L. McIntire, and H. L. Windom.
Journal of the Waterways, Harbors and Coastal Engineering Division, American Society of Civil Engineers, Vol 101, No WW3, Proceedings Paper 11530, p 269-276, August 1975. 5 fig, 1 tab, 16 ref, 1 append.

Descriptors: *Aquatic plants, *Marshes, *Revegetation, *North Carolina, *Georgia, Coastal engineering, Dredging, Environmental effects, Environmental engineering, Reclamation, Spoil banks, Harbors, Marsh plants, Vegetation establishment, Tidal marshes, Salt marshes, Southeast U.S.
Identifiers: Coastal salt marshes, Dredge spoils, Hydraulic excavation, Transplantation, Spartina alterniflora, Marsh regeneration, Silt-clay spoil site.

Spoil from the dredging of harbors, rivers, and the Inland Waterway when deposited on salt marshes often permanently destroyed these important natural resources. Portions of destroyed marsh could be restored through transplantation of the major marsh plant spartina alterniflora. This was accomplished in a typical silt-clay spoil site along the Intra-coastal Waterway in Georgia for less than $100 per acre. Thirty percent of the transplants survived and were continuing to spread 18 months after planting. Elevation of the soil was of prime importance for transplants; at lower elevations survival rates were as high as 75%. The use of seeds and nursery grown seedlings was not as successful; only 13% of the seeds germinated and none of the seedlings survived. The success of the transplantation experiment on the silt-clay dredge spoil of Georgia attested to the real potential of rebuilding destroyed marshes all along the southeast United States coast. It was noteworthy that the technical and unskilled workers involved had no prior experience with such projects and that the cost was about $0.025 per square meter. (Roberts-ISWS)
W76-03121

UNCONVENTIONAL NUCLEAR POWER PLANT SITING OPTIONS AND WATER RESOURCE IMPACTS,
Connecticut Univ., Storrs. Inst. of Water Resources.
C. D. Stern.
Available from the National Technical Information Service, Springfield, Va 22161 as PB-248 460, $3.50 in paper copy, $2.25 in microfiche. Research Project Technical Completion Report, December 1975, 8 p. OWRT A-056-CONN(1). 14-31-0001-5007.

Descriptors: *Nuclear powerplants, *Cooling towers, *Underground powerplants, *Environmental effects, Cooling water, Water pollution sources, Thermal pollution, Sites.
Identifiers: *Electric generating stations, Salt-water cooling towers, Floating nuclear plants, *Technology assessment, Powerplant siting.

A technology assessment of three unconventional power plant siting options: floating nuclear plants, plants utilizing salt-water cooling towers, and underground nuclear plants was undertaken. Floating nuclear plants have some environmental benefits, less land-use and reduced thermal impact on the marine environment. Salt-water cooling towers offer more flexibility in power-plant siting, but emit salt to the atmosphere which in areas of low ambient salt concentrations could cause damage to certain agricultural crops and in some regions micro-meteorological problems. Underground nuclear plants do not appear to offer sufficient advantage to offset the added construction costs, and it is unlikely that they will be permitted to be built any closer to population centers than conventional nuclear plants. (de Lara-Connecticut)
W76-03135

CONTROL OF NITROGEN TRANSFORMATIONS IN SOILS,
Iowa State Univ., Ames. Dept. of Agronomy.
For primary bibliographic entry see Field 5B.
W76-03141

HEAT ASSIMILATIVE CAPACITY OF THE SANGAMON RIVER,
Illinois State Water Survey, Urbana.
For primary bibliographic entry see Field 5B.
W76-03142

DYNAMIC WATER QUALITY MANAGEMENT STRATEGIES,
Washington Univ., Seattle. Dept. of Civil Engineering.
D. P. Lettenmaier, and S. J. Burges.

Journal Water Pollution Control Federation, Vol 47, No 12, p 2809-2819, December 1975. 1 fig, 1 tab, 14 ref.

Descriptors: *Water quality control, *Management, *Design, *Streams, Constraints, Monitoring, Probability, Control, Rivers, Reach(Streams), Mathematical models, Systems analysis, Simulation analysis, *Permits, Water permits.
Identifiers: *Multiple objectives, Modeling permits, System dynamics, Control loop, Time scale.

The complexity of the water quality management problem is greatly increased by the transient nature of the goals and multiple objectives of the management system. Consequently, considerable flexibility must be built into a management system design. The design problem may be aided by viewing the system as a control loop. Management requirements are conveniently summarized in a management time scale. Described are three broad classes of stream water quality management that reflect the degrees of technical and management sophistication required for permits written to accomodate uncertainty in stream water quality dynamics, uncertainty in management goals, and constraints imposed on the managing agency. Guidelines for choosing one of the three possible classes of management are presented and depend on the management time scale and model level specified. It is important to examine what constitutes the total management system proposed. The specific components investigated include the physical system dynamics, management system dynamics, and measures of the state of the physical system. The possibility of a combined strategy of monitoring and modeling is considered in view of the uncertainty associated with estimates of quality vectors. The use of a permit system allows the flexibility necessary to handle multiple transient objectives. In general, shorter management time scales imply more sophisticated management systems. (Bell-Cornell)
W76-03158

ADMINISTRATION: SYSTEMS ANALYSIS, (LITERATURE REVIEW),
Cornell Univ., Ithaca, N. Y. School of Civil and Environmental Engineering.
For primary bibliographic entry see Field 6A.
W76-03159

MODELS OF LAND AND WATER ALLOCATION TO IMPROVE ENVIRONMENT AND WATER QUALITY THROUGH SOIL LOSS CONTROLS,
Iowa State Univ., Ames. Center for Agricultural and Rural Development; and Iowa State Univ., Ames. Dept. of Economics.
E. O. Heady, and K. J. Nicol.
Water Resources Research, Vol 11, No 6, p 795-800, December 1975. 4 fig, 5 tab, 4 equ, 3 ref.

Descriptors: *Water quality control, *Environment, *Water allocation(Policy), Land resources, Agriculture, United States, Water supply, Crops, Livestock, Technology, Evaluation, Economic impact, Optimization, Constraints, Equations, Mathematical models, Systems analysis.
Identifiers: Land allocation, Soil loss controls, Cost minimization.

A soil loss, land-water allocation optimization model has been developed that is applicable to all agricultural land in the United States. The model includes 223 producing areas, 1891 land resource areas, and 51 water supply regions. Different cropping systems and technologies are defined for each crop and livestock system in each of the 1891 land resource regions. The programming model is thus of very large scale, including also a transportation submodel and market regions. As a means of water quality improvement, limits are placed in the per acre per year soil loss as a means of reducing sedimentation and the transport of nitrogen and phosphates into streams. A nitrogen balance equation limits fertilizer purchases and forces utilization of livestock wastes in the region. The model forces a land use system and set of technologies over the country and interregionally having soil loss unrestricted, at 10 tons per acre, at 5 tons per acre, and at 3 tons per acre. The unrestricted and 5-ton limits are reviewed in this paper in relation to impacts on soil loss (reduced about 25%), crop distribution, technology, water use, and farm prices. (Bell-Cornell)
W76-03164

WATER QUALITY PERCEPTION BY USERS: CAN IT SUPPLEMENT OBJECTIVE WATER QUALITY MEASURES,
Great Lakes Forestry Research Center, Sault Sainte Marie (Ontario).
J. A. Nicolson, and A. C. Mace, Jr.
Water Resources Bulletin, Vol 11, No 6, p 1197-1207, December 1975. 8 tab, 9 ref.

Descriptors: *Water resources, *Recreation, *Water pollution, *Measurement, Parks, Water sampling, Lakes, Evaluation, Management, *Minnesota, Water quality control, Attitudes, Social values.
Identifiers: Perception, Interviews.

Personal interviews were conducted with eighty campers in each of three Minnesota state parks to investigate the water quality perception of the recreationist. Simultaneously, water quality factors were measured or observed as an indication of conditions experienced by the interviewees. Most respondents perceived water pollution strictly on a visual basis, with sewage, public carelessness, industry, and farm fertilizers seen as major causes of water pollution. Seventy percent felt their recreational activities did not contribute to water pollution. Sixty-two percent said their life had not been affected by water pollution, while over two-thirds of the remaining thirty-eight percent listed curtailment of recreation as the primary result. Many mentioned an algal bloom at one park and the strong odor of rotten fish at a second park. It has been concluded that these were the only major problems in the three parks. Some incipient problems, such as nutrient enrichment and the presence of coliform bacteria, were indicated by the measurements. The type and degree of pollution identified by the recreationist could be important through its influence on user evaluations and space preferences. The establishment of relationships between water quality parameters and the perception of the recreationist will provide the manager with a tool to assist in evaluating participation in water-related outdoor recreation in terms of both user satisfaction and water quality. (Bell-Cornell)
W76-03168

LATEX PAINT WASTES--MUNICIPAL CHARGES AND TREATMENT,
East Bay Municipal Utility District, Oakland, Calif.
For primary bibliographic entry see Field 5D.
W76-03199

A NOTE ON OPTIMAL TAXATION OF ENVIRONMENTAL SPILLOVERS,
Cornell Univ., Ithaca, N.Y.
P. Pestieau.
Journal of Environmental Economics and Management, Vol 2, No 1, p 34-39, September, 1975. 7 ref.

Descriptors: *Pollution charges(Taxes), *Model studies, *Tax rates, *Industrial wastes, *Economics, Waste water treatment, Treatment facilities, Water pollution control, Pollution abatement.
Identifiers: Effluent taxes, Economic models.

An economic model was formulated to determine the environmental policy for the situation where industrial pollution can be reduced partially by effluent taxation and partially by a publically owned waste treatment plant. The setting for the policy decision was a competitive economy with constant returns to scale technology and commodity taxation. In the case of increasing returns to public abatement, an effluent tax set at marginal user cost does not generate enough revenue to finance the facility. Thus, the problem lies in finding additional revenue most efficiently. This problem is discussed in the framework of commodity taxation. The cost of pollution control is shifted to the consumers, and taxes derived on efficiency grounds might prove to have a regressive incidence which can be avoided only by considering social welfare functions. (Kramer-FIRL)
W76-03202

EFFICIENCY OF POLLUTION TAXATION AND MARKET STRUCTURE,
Colorado Univ., Boulder.
D. R. Lee.
Journal of Environmental Economics and Management, Vol 2, No 1, p 69-72, September, 1975. 5 ref.

Descriptors: *Pollution charges(Taxes), *Water pollution control, *Tax rates, Pollution abatement, Costs, Industrial wastes, Economics.
Identifiers: Market structure.

The performance of a uniform pollution tax in achieving a given level of pollution at least cost is examined. A lack of attention has been given to market organization in discussing externalities and pollution control. It was demonstrated that unless all polluting firms have the same elasticity of demand at their equilibriums, imposing the same per-unit pollution tax on each firm will not result in a minimum cost reduction in pollution. The same pollution reduction could be achieved at a lower cost with increased reduction by firms with high demand elasticity and less reduction by firms with low demand elasticity. In general, least-cost abatement will not result from a pollution tax uniformly applied. The situation where differing degrees of market power exist among polluters and the possible patterns of pollution taxes to achieve least-cost abatement are discussed. (Kramer-FIRL)
W76-03204

OPTIMAL POLLUTION CONTROL WITH A NONCONSTANT EXPONENTIAL RATE OF DECAY,
Guelph Univ., (Ontario). Dept. of Economics.
B. A. Forster.
Journal of Environmental Economics and Management, Vol 2, No 1, p 1-6, September, 1975. 3 fig, 10 ref.

Descriptors: *Water pollution control, Hydrologic aspects, *Lakes, *Mathematical models, Economics, Model studies, Planning, Water management(Applied), Water resources development, Optimization.

While most recent pollution control studies have assumed a constant exponential decay rate, this paper examines the effects of introducing a non-constant exponential decay rate into a pollution control model. The question posed to the economist was whether it is ever optimal to let a waterway such as Lake Erie die. If the pollution level becomes great enough, a waterway may be unable to cleanse itself. A model was formulated, allowing for the fact that pollution may depress the rate of selfpurification of a body of water. A previously defined decay function was used to outline a descriptive theory of pollution and capital accumulation. The analysis suggested that the choice of cleaning up overly polluted lakes is dependent upon the social welfare objectives and priorities of the particular society. (Kramer-FIRL)
W76-03206

ENERGY DISSIPATOR AIDS FIGHT AGAINST HIGH PRESSURE PROBLEMS.
For primary bibliographic entry see Field 4B.
W76-03212

PRIVATE CONSTRAINTS ON GROUNDWATER CONTAMINATION,
Virginia Polytechnic Inst. and State Univ., Blacksburg. Water Resources Research Center.
For primary bibliographic entry see Field 4B.
W76-03244

CAN WE AFFORD ZERO POLLUTION RISK,
Texas Univ. at Austin. Dept. of Civil Engineering.
J. O. Ledbetter.
Water and Sewage Works, Vol 122, No 9, p 104-105, September, 1975. 5 ref.

Descriptors: *Pollution abatement, *Statistics, Toxicity, Public health, Epidemiology, Water pollution, Air pollution, Standards, Pollutants, Waste assimilative capacity.
Identifiers: Zero discharge.

The goal of zero pollution has been developed by an advertising campaign by Federal environmental agencies and the zero defects concept from the space program. The pollution regulatory agencies use the health effects of pollutants as the reason for pollution control and use the advertising campaign to build their empires through increased budget appropriations from a frightened congress. Toxicologists believe that small doses of toxic materials will stimulate while epidemiologists maintain that even a small exposure to a large population for a long period of time can cause disease. The epidemiologist arrives at this conclusion through the use and misuse of statistics. Life scientists are overawed by statistics and assume spurious and specious correlations and then use these correlation to prove cause-effect relationships. Spurious and specious correlations will continue to be promoted as long as publicity or appropriations of money for studying the pollutant are to be gained. However, there is a chance that many actions taken to prevent some real or imagined ill will cause more damage than the status quo. Pollution control should be free of ambivalence, and a single air quality standard for the entire country should not be adopted. The environment can safely assimilate at least small amount of pollutants. The proper level of pollution control will ensure a balance of sociological desireability, technological capability, economical feasibility, and environment assimiliability. (Orr-FIRL)
W76-03249

HYGIENIC ASSESSMENT OF THE FLOTATION REAGENT T-66 IN THE WATER BODIES AND ITS MAXIMUM PERMISSIBLE CONCENTRATION (GIGIENICHESKAYA OTSENKA FLOTOREAGENTA T-66 V VODE VODOEMOV I EGO PREDEL'NO DOPUSTIMAYA KONTSENTRATSIYA),
For primary bibliographic entry see Field 5C.
W76-03255

RESEARCH NEEDS FOR WATER RESOURCES CONTROL IN CALIFORNIA.
California State Water Resources Control Board, Sacramento. Div. of Planning and Research.
Publication No 48, April 1973. 55 p.

Descriptors: *Water quality control, *California, *Research and development, Methodology, Water rights, Groundwater, Water pollution control, Water pollution effects, Toxins, Nutrients, Disinfection, Recycling, Waste treatment, Sludge disposal, Water reuse, Erosion, Silting, Eutrophication, Encroachment, Salinity, Oil spills, Mine wastes, Monitoring, Waste disposal, Legal aspects, Economics, Institutional constrains, Irrigation water, Heavy metals, Geologic formations.

The California State Water Resources Control Board defines water quality control related problems, outlines research needs to solve these problems and presents policy guidelines for establishing priorities, funding and evaluating proposals. In its research program the Board assigns highest priority to the development of methodology and data for the State Board and the nine regional water quality control boards. Three classes of research priorities are established. Research areas included in Priority I are methodology and data for analysis of water rights applications, impact of wastes on groundwater, and influence of toxicants and biostimulants on surface water; reliable disinfection systems; recycling and use of wastewater solids and reclaimed wastewater; and control of pollution from irrigated agriculture. Control of water quality are surveyed in such areas as erosion and siltation, degradation of groundwaters, increasing salinity of surface water, eutrophication, toxicity, oil and other hazardous material spills, mine wastes and geochemical hazards. Procedures and problems in water quality monitoring, wastewater treatment residue processing and disposal, reclamation and reuse are described. Perhaps the most difficult problems to resolve are those in the legal, economic and institutional fields. (Carpenter-Wisconsin)
W76-03265

RESIDUAL CHARGES AND PROFITS,
Pennsylvania State Univ., University Park. Center for the Study of Environmental Policy.
R. J. Anderson, and T. A. Ferrar.
Working Paper No 1, November 1973. 9 p, 6 ref.

Descriptors: *Pollution abatement, *Pollution taxes(Charges), Industries, Investment, Costs, Motivation, Compensation, Profit.
Identifiers: Subsidies.

A common contention is that residual charges for pollution control will profits for firms. Such a viewpoint is, naturally enough, often espoused by industry representatives. Economists do not generally favor such a position based on the assumption that if charges are levied firms will very quickly find an efficient way to remove the pollutants and continue to run their operation efficiently. This study examines the problem of finding a residual charge that will not adversely affect profits. The key concept is that firms will be motivated to reduce pollution by the marginal rather than the total tax imposed. A tax proposed by the President in 1973 is examined and found to involve a heavy tax burden. A modification is suggested that contains an incentive and this substantially reduces the tax liability. Some discusstion examines briefly the principles for setting appropriate tax levels for pollution control. The more ways a policy can be interpreted the greater is its opportunity for successful adoption. (Carpenter-Wisconsin)
W76-03267

EFFLUENT CHARGES, ENVIRONMENTAL QUALITY AND OTHER NATIONAL GOALS: A QUALIFICATION,
Pennsylvania State Univ., University Park. Center for the Study of Environmental Policy.
G. Neumann, and T. Ferrar.
Working Paper No 7, (1974). 8 p, 6 ref.

Descriptors: *Pollution taxes(Charges), *Economic impact, *Employment, Industrial production, Byproducts, Equations, Theoretical analysis.

The theory that the impact of pollution taxes will affect the economic national goals by reducing industrial production is examined by utilizing equations for a firm that has both input and output substitution possibilities. That is, the employment of inputs such as raw materials, labor, and equipment results in the production of the intended final product, one or more byproducts, and one or more waste products. The economic literature has ignored the production of byproducts and very little attention has been given to the decisions which implicitly generate their production. The essential point is made that except in the case in which waste products and/or byproducts are joint products, in the sense that a given amount of each is necessarily produced for each unit of primary output, the firm must make an economic decision of how much of each to produce. It is contended that while effects of reduction in production output would possibly be realized from the implementation of a waste tax policy, it also highlights the production characteristics which must be examined in order to conclude that output and employment will be impacted. Specifically, the existence of technological parameters must be empirically examined before conclusive statements can be made concerning the effect of waste charges on employment. (Auen-Wisconsin)
W76-03268

A SOCIOLOGICAL ASSESSMENT OF ECONOMIC INCENTIVES FOR INDUSTRIAL POLLUTION ABATEMENT,
Pennsylvania State Univ., University Park. Center for the Study of Environmental Policy.
E. R. Hammer.
Working Paper No 9, (1974). 21 p, 24 ref.

Descriptors: *Pollution abatement, *Industries, *Motivation, *Pollution taxes(Charges), Regulation, Government finance, Penalties(Legal), Judicial decisions, Standards, Employment, Behavior, Political aspects, Geographical regions.
Identifiers: *Resource charge, Abatement subsidy.

'Judicial action' is the major policy currently employed by the government in industrial pollution abatement. This policy emphasizes courtroom activity and accompanying legal regulation, whereby legislation is enforced by 'public agencies'. The discussion revolves on the inability of this system to address the necessity for 'economic incentives', and analyses two other policies for industrial pollution abatement--the 'resource charge' and the 'abatement subsidy'. The 'resource charge' policy is strongly supported by economists who approach pollution abatement from a non-crisis position. Through this approach the gap between private (production) and social (pollution) abatement costs would be closed as the pollution-penalty system became an integral part of the firm's production system. 'Abatement subsidy', on the other hand, utilizes the principle of positive incentives. On economic theory alone the resource charge alternative appears the most applicable. However, when assessing abatement from a crisis perspective, such non-economic factors as time, political manipulation, and public support become important. The conclusion is that a subsidy program (based on positive reinforcement) may be a more efficient policy for bringing about a short-run pollution abatement under crisis conditions. (Carpenter-Wisconsin)
W76-03269

FINANCIAL INCENTIVES AND POLLUTION CONTROL. A CASE STUDY,
Pennsylvania State Univ., University Park. Center for the Study of Environmental Policy.
T. A. Ferrar, A. B. Brownstein, J. P. Simpson, and S. Streiter.
Report No 16, December 1974. 55 p, 7 ref. EPA 68-01-2250.

Descriptors: *Air pollution, *Standards, *Fuels, *Oil, *Regulation, *Assessments, Pollution abatement, Decision making, Sulfur, Pricing, Administration, Northeast US, New York.
Identifiers: *Variant pollution standards, *Surcharges, Fuel oil, New York(NY), Boston(Mass).

The energy crisis has produced considerable clamour that air pollution control restrictions be relaxed to allow utilization of available energy sources. Environmentalists consider the relaxation of air quality standards, as a retrograde step. Economists see groups seeking relaxation of regulations as having financial incentives to push such permission, if granted, to the limit. Public officials have the task, given these circumstances, of judging the merit of applications for relaxing the pollution regulations, against their obligation to ensure that air quality improvement progress is maintained. Shortages of low-sulfur residual fuel oil in the Northeast U.S. in 1972-73 and 1973-74 meant air quality standards had to be relaxed by allowing higher sulfur-content in fuel oil. This experience provides the basis for this study, which however, is qualitative and descriptive rather than quantitative as those interviewed were reluctant to release confidential information given the market and policy uncertainties. A desirable policy on variance of standards combines a uniform variance structure and a fuel-oil surcharge. The surcharge should more than compensate for the price (and/or profit) differential involved in using sulfur conforming and noncomforming fuels to encourage use of environmentally acceptable fuels where possible. The alternative policy tool of emission taxes is also reviewed. (Carpenter-Wisconsin)
W76-03270

ENVIRONMENT LAWS MAY CLOSE MANY USA FISH FACTORIES.
Fishing News International, Vol 6, No 13, p 28-33, 1975.

Descriptors: *Water quality standards, *Water pollution control, *Fish handling facilities, *Economic impact, *Canneries, Industrial production, Commercial fish, Marine fish, Shellfish, Costs, Safety factors, Economies of scale, Prices, Oysters, Clams, Bottom fish, Salmon.
Identifiers: *Seafood processing industry.

The views of the National Marine Fisheries Service regarding the national effluent guidelines for seafood processors are given. Costs of these requirements are almost prohibitive, will increase consumer costs, and divert funds from expansion needs. Environmental spending would boost the annual inflation rate 0.3-0.5%. The industry has many small plants--42% have sales less than $100,000, consequently the suggested pollution abatement methods would equal or exceed their yearly sales figures. Only 17% have sales exceeding $1 million. The proposed guidelines will affect 70% of the processors. Total capital investment held would be $375 million, yearly operating and maintenance costs $3.5-10 million, and monitoring $1-1-1/2 million a year. Price effects caused by pollution controls are the most critical factor in determining the economic impact. These will depend on the plant, the area, and cost of foreign products. The Environmental Protection Agency assumption that the price effects will approximately equal the pollution abatement costs incurred by the largest processor is correct for the large processor, but small processors cannot compete. The smallest plants are exempt, but middel-sized plants will probably not be able to withstand the cost. The oyster, clam, bottomfish, and salmon industries will be hardest hit. (Buchanan-Davidson--Wisconsin)
W76-03273

INTERDEPENDENCE OF AIR, WATER, AND SOIL POLLUTION CONTROL STRATEGIES IN A POWER PLANT AND A KRAFT MILL,
Battelle Columbus Labs., Ohio.
For primary bibliographic entry see Field 5D.
W76-03297

BIBLIOGRAPHY OF WATER POLLUTION CONTROL BENEFITS AND COSTS,
Development Planning and Research Associates, Inc., Manhattan, Kans.
S. G. Unger, and D. L. Jordening.
Available from the National Technical Information Service, Springfield, Va 22161 as PB239-424, Price $7.50 in paper copy, $2.25 in microfiche. Report No. EPA-600/5-74-028, October 1974. 187 p. 1B1030/ROAP 20aab-02. EPA 68-01-6237.

Descriptors: *Bibliographies, *Water pollution control, *Benefits, *Costs, Cost-benefit analysis, Water quality standards, Water resources development, Environment, Economics, Waste disposal, Pollutants, Water treatment, Sewage treatment, Water distribution(Applied), Facilities, Air pollution.

This bibliography of water pollution control benefits and costs contains 3000 references alphabetized by author. It was part of a project to extrapolate regional estimates of water quality enhancement programs for a preliminary estimate of national water pollution control benefits and costs. The primary selection criteria was that the citation pertained to water pollution control benefits and costs. However more general environmental issues with water quality problems are included. Much of the economic cost-benefit analysis research was conceptually developed and/or applied in resource-use areas other than water; however the concepts are important to water resources research, so these articles are included in this bibliography. Books, journal articles, trade publications, reserach reports, and unpublished reports of on-going research in public and private agencies were the sources for the references. (Buchanan-Davidson--Wisconsin).
W76-03298

THE RECOVERY OF FE, MN AND AL FROM A MINE WATER EFFLUENT,
Potchefstroom Univ., for C. H. E. (South Africa). Dept. of Industrial Chemistry.
S. R. Van Der Walt, R. Van Eldik, and H. G. J. Potgieter.
Water Research, Vol 9, No 10, p 865-868, October, 1975. 5 fig, 8 ref.

Descriptors: *Analytical techniques, Metals, Separation techniques, *Iron, *Manganese, *Aluminum, Effluents, Oxidation, Mine water, Industrial wastes.
Identifiers: *Aluminates, South Africa, Metals recovery.

Some preliminary results are reported on an attempt to devise methods for the removal of Fe, Mn, and Al. The possibilities studied include oxidation, precipitation, complexation and separation by the formation of aluminates at high pH. The mine water investigated contains considerable quantities of Fe, Mn, and Al. Recovery of the pure metals is obstructed by the presence of impurities such as Zn, Ni, Co, Cu and Th. The oxidation of the effluent results in practically complete separation of Fe and Mn, though both fractions contain Al as an impurity. (Hoyle-Vanderbilt)
W76-03312

MINE DRAINAGE POLLUTION REDUCTION BY INHIBITION OF IRON BACTERIA.
Harvard Univ., Cambridge, Mass. Lab. of Applied Microbiology.
F. Walsh, and R. Mitchell.
Water Research, Vol 9, No 5/6, p 525-528, 1975. 1 fig, 5 tab, 6 ref.

Descriptors: *Acid mine water, *Acid bacteria, Iron, *Mine drainage, *Mine wastes, Microbiology, Pollution abatement, Inhibition.
Identifiers: *Metallogenium, *Thiobacillus ferro oxidants.

The effect of increasing influent ferrous iron concentrations on the amount of total iron and acidity released in drainage from coal mine tailings is described. Observed concurrent decrease in effluent Thiobaccilus and Metallogenium population suggests that the increased influent ferrous iron concentration inhibited the catalytic actitivy of the iron bacteria by preventing growth of significant metallogenium populations. A combination of increasing mine influent ferrous iron concentrations with mine sealing may significantly reduce acidity and total iron releases from working or abandoned coal mines. (Hoyle-Vanderbilt)
W76-03314

ENVIRONMENTAL CLEANUP 1975-1985: HUGE NEW COSTS,
F. C. Olds.
Power Engineering, Vol 79, No 9, p 38-45, September, 1975. 2 fig, 4 tab.

Descriptors: *Environmental effects, *Water quality control, Water pollution control, Pollution abatement, Legislation, Federal Water Pollution Control Act, Federal jurisdiction, Costs, Economics.
Identifiers: Zero pollution discharge.

An overview of the costs of environmental cleanup for the past five years and for the next decade is presented. Major federal regulations for both air and water pollution control are summarized. Published figures from agencies showed cleanup costs to be $300 billion. This did not include the $15 to $20 billion of capital to build power plants each year due to environmentally related stretch-outs in schedules or the $4 to $5 billion annually spent to purchase oil to substitute for unfinished nuclear plant. The costs also failed to include those of acid mine drainage, agricultural feed lot runoff, urban storm water runoff problems, zero discharge, and other hydrological and environmental problems. Present laws have proved unworkable and unrealistic. Proposed costs to meet the 'best available technology' standard set forth for 1983 were estimated at $220 billion for 1972 to 1983. If zero discharge is enforced, the impact on land and aquifers from the impoundment of water containing BOD, chemicals and fine solids may be serious. Other costs related to the enforcement of environmental regulations are less direct, such as the cost to industry of pollution abatement, which will be passed on to the consumer in the form of higher prices for various products. (Kramer-FIRL)
W76-03322

COMPUTER CONTROLS PUT 'WASTE' WATER TO GOOD USE,
Central Contra Costa Sanitary District, Walnut Creek, Calif.
For primary bibliographic entry see Field 5D.
W76-03323

WATER AND THE SOUTH FLORIDA ENVIRONMENT,
Geological Survey, Miami, Fla.
For primary bibliographic entry see Field 5C.
W76-03402

DO HEAVY METALS PREVENT THE AGRICULTURAL USE OF MUNICIPAL SLUDGE,
Royal Danish School of Pharmacy, Copehagen.
For primary bibliographic entry see Field 5E.
W76-03409

THE EFFECTS OF FRESHWATER INFLOWS ON HYDROLOGICAL AND BIOLOGICAL PARAMETERS IN THE SAN ANTONIO BAY SYSTEM, TEXAS,
Texas Parks and Wildlife Dept., Austin, Coastal Fisheries Branch.
For primary bibliographic entry see Field 2L.

W76-03420

THE PROCEEDINGS OF A NATIONAL SYMPOSIUM ON THE STATE OF AMERICA'S DRINKING WATER.
North Carolina Water Resources Research Inst., Raleigh.
For primary bibliographic entry see Field 5F.
W76-03422

THE DEVELOPMENT AND APPLICATION OF THE 1974 DRINKING WATER STANDARDS,
Environmental Protection Agency, Washington, D.C. Office of Water Supply.
For primary bibliographic entry see Field 5F.
W76-03424

AN APPROACH TO PROVISION OF RURAL WATER SUPPLIES,
Conset, Inc., Washington, D.C. National Demonstration Water Project.
For primary bibliographic entry see Field 5F.
W76-03437

TRAINING OPPORTUNITIES AND THE SAFE DRINKING WATER ACT,
Greensboro Public Works, N.C.
For primary bibliographic entry see Field 5F.
W76-03440

REPORT ON ENVIRONMENTAL STUDY INTO THOMSON DAM AND ASSOCIATED WORKS.
Melbourne and Metropolitan Board of Works (Australia).
For primary bibliographic entry see Field 6G.
W76-03448

PRESENT AND FUTURE REQUIREMENTS OF THE CHLOR-ALKALI INDUSTRY FOR EFFECTIVE POLLUTION CONTROL,
Crawford and Russel, Inc., Stamford, Conn.
For primary bibliographic entry see Field 5D.
W76-03497

INDUSTRIAL REQUIREMENTS FOR EFFECTIVE POLLUTION CONTROL. AUTOMOBILE INDUSTRY,
General Motors Corp., Warren, Mich. Environmental Activities Staff.
J. S. Delos.
In: Electrochemical Contributions to Environmental Protection, Theodore R. Beck, et al, editors. The Electrochemical Society, Inc, Princeton, New Jersey, 1972, p 29-39.

Descriptors: *Industries, *Pollution abatement, *Measurement, *Analytical techniques, Equipment, Michigan, Ohio, Waste water(Pollution), Cations, Anions, Organic compounds, Pesticides, Herbicides, Taste, Odor, Toxins, Safety, Effluents, Air pollution, Chromium, Instrumentation, Pollutant identification.
Identifiers: *Automobile industry, Noise, Cyanide.

The present capability and future requirements for analyses of effluents, toxins, noise, and organoleptic properties are discussed. Michigan requires industries that discharge waste water into streams or sewer systems to report information to the Water Resources Commission on 13 cations, 3 anions, 23 specific organic compounds, 11 classes of organic compounds, 11 taste-and-odor compounds, 2 classes of taste-and-odor compounds, 2 herbicides, and 6 pesticides. Ohio adopted a resolution concerning discharge of toxins into state waters which includes safeguards for toxins. Analysis of organic compounds is very complex. Concern for noise pollution is growing. Instrumentation is needed to accurately determine the combined noise exposure during a work day. Odor measurement is subjective, but measurement should be possible. Analysis of air pollution includes carbon dioxide, carbon monoxide, hydrocarbons, nitric acid, nitrogen dioxide, particulate matter, and sulfur dioxide. Available instrumentation is often bulky, expensive, unreliable, and requires specially trained operators. The expressed preference is toward instruments that are small, simple, reliable, portable units that are parameter specific rather than large all-inclusive units designed to measure any parameter. (Buchanan-Davidson--Wisconsin)
W76-03498

6. WATER RESOURCES PLANNING

6A. Techniques Of Planning

PROCEEDINGS OF THE CONFERENCE ON INTERDISCIPLINARY ANALYSIS OF WATER RESOURCE SYSTEMS.
American Society of Civil Engineers, New York.
Available from the National Technical Information Service, Springfield, Va 22161 as PB-248 596, $11.00 in paper copy, $2.25 in microfiche. Conference held June 19-22, 1973 at University of Colorado, Boulder. An American Society of Civil Engineers Research Activity, ASCE Project No 201.07/17-3.72-4, New York, NY, 1975. 403 p, 19 fig, 9 tab, 9 equ, 26 ref, $8.00 J E Flack, ed. OWRT X-126(3757)(1).

Descriptors: *Water resources development, *Management, *Comprehensive planning, *Systems analysis, United States, Economics, Water policy, Decision making, Social aspects, Coordination, Projects, Africa, Reservoirs, Effects, Communication, Great Lakes, Evaluation, Simulation analysis, Alternative planning, Water quality, Geothermal studies, Regions, Long-term planning, Methodology, River basins, Ecology, Universities, Mathematical models, Research.
Identifiers: *Interdisciplinary analysis, Multidisciplinary, Multiobjective, Political science, Socio-economics, Law, Environmental quality, Man-made lakes, Prediction, Mass balance, Imperial Valley(Cal), North Atlantic Study, Maline Creek(Mo), Plan formulation, Choice approach, Wisconsin River, Lower Fraser River(Brit. Columbia), Least cost, Human judgement.

The Water Resources Systems Committee of the American Society of Civil Engineers' Technical Council on Water Resources Planning and Management saw a critical need for developing an interdisciplinary approach to water resources development. This Conference was intended as an effective means of advancing the systems approach in this area. Formal papers on six interdisciplinary efforts were selected as case studies, around which discussions were built. These six papers include interdisciplinary studies on: (1) large reservoirs in Africa; (2) limnological modeling of the Great Lakes; (3) geothermal development; (4) the North Atlantic Regional Water Resources Study; (5) Corps of Engineers planning experience in the St. Louis-Maline Creek; and (6) university research in the Wisconsin River and the Lower Fraser River (Brit. Columbia) water quality studies. Discussions are given after each paper. Included also is an introductory article on the interdisciplinary aspects of water resources planning and management. Panels on discipline viewpoints of interdisciplinary analysis of water resource systems both procede and follow the section containing the formal papers. These present articles on socioeconomics, political science and law, ecology, an overview of interdisciplinary issues, and interdisciplinary planning and the use of the systems analysis concept in planning. The overall objective is to discover how many and in what ways disciplines can cooperate and coordinate their efforts leading to improved, comprehensive analysis and eventual solution of our water resources problems. (See W76-00061 thru W76-00080) (Bell-Cornell)
W76-03005

DYNAMIC WATER QUALITY MANAGEMENT STRATEGIES,
Washington Univ., Seattle. Dept. of Civil Engineering.
For primary bibliographic entry see Field 5G.
W76-03158

ADMINISTRATION: SYSTEMS ANALYSIS, (LITERATURE REVIEW),
Cornell Univ., Ithaca, N. Y. School of Civil and Environmental Engineering.
D. P. Loucks.
Journal Water Pollution Control Federation, Annual Literature Review, Vol 47, No 6, p 1783-1789, June 1975, 41 ref.

Descriptors: *Water pollution control, *Management, *Planning, *Design, *Systems analysis, Waste water treatment, Decision making, Water quality, Bibliographies, Cost-benefit analysis, Economics, Optimization, Simulation analysis, Dynamic programming, Linear programming, Mathematical models, *Reviews.
Identifiers: Cost-effectiveness, Predicting, Cost-minimization, Nonlinear programming, Least squares, Eigen-value perturbation, Parametric differentiation, Multivariate statistical techniques, Streeter-Phelps equation, Chance-constrained quadratic programming, Mixed-integer programming.

The 1974 literature on the development and application of systems analysis techniques for defining and evaluating alternative water pollution control policies can be divided into six categories: (1) water quality modeling methods; (2) computer simulation studies; (3) metropolitan water quality studies; (4) wastewater treatment systems analysis; (5) salinity and thermal pollution analysis; and (6) water quality surveillance planning. This article enumerates and briefly summarizes forty-one documents (articles, reports and conference proceedings) pertinent to the field of water pollution control and wastewater treatment. The writings include a broad spectrum of mathematical modeling techniques, such as simulation analysis, linear programming, nonlinear programming, dynamic programming, chance-constrained quadratic programming, and mixed-integer programming, as well as other optimization methods, to estimate feasible and often minimum-cost design and management alternatives for water quality planning. (Bell-Cornell)
W76-03159

RESERVOIR MANAGEMENT MODELS,
Yale Univ., New Haven, Conn. School of Organization and Management.
For primary bibliographic entry see Field 4A.
W76-03162

ECONOMIC ASSESSMENT OF AN ACTIVITY ANALYSIS MODEL FOR WATER SUPPLY PLANNING,
Utah State Univ., Logan. Dept. of Civil and Environmental Engineering; and Utah Water Research Lab., Logan.
For primary bibliographic entry see Field 5D.
W76-03163

MODELS OF LAND AND WATER ALLOCATION TO IMPROVE ENVIRONMENT AND WATER QUALITY THROUGH SOIL LOSS CONTROLS,
Iowa State Univ., Ames. Center for Agricultural and Rural Development; and Iowa State Univ., Ames. Dept. of Economics.
For primary bibliographic entry see Field 5G.
W76-03164

INTERVENTION ANALYSIS IN WATER RESOURCES,
Waterloo Univ., (Ontario). Dept. of Civil Engineering.
For primary bibliographic entry see Field 2E.
W76-03165

USE OF RISK PREMIUMS IN CHANCE-CONSTRAINED DYNAMIC PROGRAMING,
New South Wales Univ., Kensington (Australia). School of Civil Engineering.
A. J. Askew.
Water Resources Research, Vol 11, No 6, p 862-866, December 1975. 3 fig, 2 tab, 2 equ, 4 ref.

Descriptors: *Water resources development, *Operations, *Water policy, *Dynamic programming, *Stochastic processes, Probability, Discount rates, Economics, Feasibility, Constraints, Optimization, Costs, Benefits, Forecasting, Algorithms, Equations, Systems analysis, Mathematical models, Risks.
Identifiers: *Risk premiums, Benefit maximization, Chance-constrained programming, Economic penalty, Failure penalty, Water release.

Stochastic dynamic programming offers a powerful means of deriving optimum operating policies for water resource systems. In order to limit the probability of system failure associated with such policies, it is necessary to ammend the standard algorithm and use some form of chance-constrained dynamic programming. This technique may involve an iterative search based on variations in such parameters as the penalty for failure or the discount rate. Use of the latter parameter is found to be quite feasible and is analogous to the imposition of risk premiums when one is investing in less secure ventures: the greater the probability of failure, the greater the premium demanded. (Bell-Cornell)
W76-03166

A TIMBER-WATER SIMULATION MODEL FOR LODGEPOLE PINE WATERSHEDS IN THE COLORADO ROCKIES,
Colorado State Univ., Fort Collins, Dept. of Forest and Wood Sciences.
For primary bibliographic entry see Field 4D.
W76-03167

RESOURCE ALLOCATION UNDER UNCERTAINTY,
California Univ., Berkeley. Graduate School of Public Policy.
F. H. Trinkl.
Policy Sciences, Vol 6, p 29-40, 1975. 4 tab.

Descriptors: *Resource allocation, *Markov processes, *Decision making, *Methodology, Model studies, Alternative planning, Forecasting, Probability, Hawaii, *Risks.

Policy makers face a problem of how to make decisions in the real world because of basic uncertainty and lack of information. Possible decision rules under uncertainty are examined. The conventional approach is to average the available, even when combined with sensitivity analysis, limits substantive guidelines. The model described is based on a Markovian resource allocation model, and, although a single-state process is presented (as applied to the mental health program for retarded adults in Hawaii), extensions to a multi-stage process can readily be made. Besides the usual requirements for a Markovian approach, sets of values reflecting judgements of decision makers concerning the relative importance of multiple objectives, are incorporated. The model allows the incorporation of production functions relating monies expended to anticipated outcomes. Although the model is open to criticism, it provides a useful framework for analyzing important policy issues by incorporating uncertainties, thus allowing the determination of preferred resource allocations. The framework precludes distinctively inferior courses of action which disguise the inherent nature of uncertainty; and it can be used to point out to decision makers the penalties (measured in achievable value loss) of simplistic arbitrary allocations. (Auen-Wisconsin)
W76-03266

HYDROGRAPHY.
For primary bibliographic entry see Field 4A.
W76-03292

RANGE AND DEFICIT ANALYSIS USING MARKOV CHAINS,
Colorado State Univ., Fort Collins.
For primary bibliographic entry see Field 2H.
W76-03354

TECHNIQUES FOR WATER DEMAND ANALYSIS AND FORECASTING: PUERTO RICO, A CASE STUDY,
Geological Survey, Reston, Va.
For primary bibliographic entry see Field 6D.
W76-03407

MATHEMATICAL OPTIMIZATION OF WATER SUPPLY SYSTEMS STATE OF THE ART,
Michigan Univ., Ann Arbor. School of Public Health.
For primary bibliographic entry see Field 5F.
W76-03441

WATER DEMAND FORECASTING--SOME CONCEPTS AND TECHNIQUES,
North Carolina Univ., Chapel Hill. Dept. of Environmental Sciences and Engineering.
For primary bibliographic entry see Field 5F.
W76-03442

ENERGY COST-BENEFIT MODELS FOR EVALUATING THERMAL PLUMES,
Florida Univ., Gainesville. Dept. of Environmental Engineering Sciences.
For primary bibliographic entry see Field 5C.
W76-03496

6B. Evaluation Process

ENERGY DEMAND AND WATER RESOURCE MANAGEMENT: SOME ECONOMIC ASPECTS,
New York State Coll. of Agriculture and Life Sciences, Ithaca. Dept. of Agricultural Economics.
For primary bibliographic entry see Field 6D.
W76-03003

PROCEEDINGS OF THE CONFERENCE ON INTERDISCIPLINARY ANALYSIS OF WATER RESOURCE SYSTEMS.
American Society of Civil Engineers, New York.
For primary bibliographic entry see Field 6A.
W76-03005

REGIONAL DEVELOPMENT: AN ECONOMETRIC STUDY OF THE ROLE OF WATER DEVELOPMENT IN EFFECTUATING POPULATION AND INCOME CHANGES,
Utah Center for Water Resources Research, Logan.
H. H. Fullerton, W. C. Lewis, J. C. Andersen, J. E. Keith, and R. Willis.
Available from the National Technical Information Service, Springfield, Va 22161 as PB-248 711, $4.50 in paper copy, $2.25 in microfiche. Utah Water Research Laboratory, Logan, Publication PRRBE089-1, June 1975. 50 p, 32 tab, 1 fig. OWRT B-089-UTAH(1). 14-31-0001-4131.

Descriptors: Economics, *Water resources development, Population, *Income, *Investment, *Regional development, *Economic impact, Rocky Mountain region, *Econometrics, Cost analysis, *Cost comparisons, *Regional analysis, Forecasting.
Identifiers: *Economic growth.

Twelve measures of regional economic growth, including population and three measures of income were compared for areas with and without water investment in 246 countries and 42 water resource subareas in the states of Utah, Colorado, New Mexico, Montana, Wyoming, Idaho, and Nevada. Simple mean comparisons for these measures compiled for the decades 1940-1950, 1950-1960, and 1960-1970 failed to support the hypothesis that economic growth of those counties and subareas receiving water investment was significantly higher than in those areas which did not, with the possible exception of the 1940-1950 decade. For small areas in New Mexico where more detailed records of water investment were available, a nine equation econometric model was estimated using three-stage least squares analysis. As specified, this model facilitated an examination of the interactive effect of water development as a causal variable and as an endogenous variable which responds to other growth inducements. Input-output and economic base-models were used to examine two case studies of water investment in Western Colorado. In this analysis it was found that total gross output attributable to the projects ranged from zero in the petroleum and mining sectors to a high of 260,302 in the dairy industry. Multiplicative effects on employment income and gross economic activity ranged from 1.06 to 2.30 times their initial magnitude. Income and employment multipliers were of similar magnitude. The input-output approach shows potential impacts from water investment in a general equilibrium context, but rests on the assumption that other concurrent events which could produce similar or offsetting effects in the region are held constant.
W76-03137

DYNAMIC WATER QUALITY MANAGEMENT STRATEGIES,
Washington Univ., Seattle. Dept. of Civil Engineering.
For primary bibliographic entry see Field 5G.
W76-03158

ADMINISTRATION: SYSTEMS ANALYSIS, (LITERATURE REVIEW),
Cornell Univ., Ithaca, N. Y. School of Civil and Environmental Engineering.
For primary bibliographic entry see Field 6A.
W76-03159

RESERVOIR MANAGEMENT MODELS,
Yale Univ., New Haven, Conn. School of Organization and Management.
For primary bibliographic entry see Field 4A.
W76-03162

WATER QUALITY PERCEPTION BY USERS: CAN IT SUPPLEMENT OBJECTIVE WATER QUALITY MEASURES,
Great Lakes Forestry Research Center, Sault Sainte Marie (Ontario).
For primary bibliographic entry see Field 5G.
W76-03168

INTERNATIONAL INVENTORY AND FORECAST OF OFFSHORE PETROLEUM AND MINERAL ACTIVITY,
Gulf Universities Research Consortium, Galveston, Tex.
A. Lohse, and J. R. Crump.
Available from NTIS, Springfield, Va 22161 as AD-A008 431, $5.00 in paper copy, $2.25 in microfiche. Department of Transportation, U.S.

Coast Guard, Washington, D.C., Office of Merchant Marine Safety, Final Report No. GURC-122, February 1973. 87 p, 15 fig, 14 tab, 3 append.

Descriptors: *Census, *Forecasting, *Evaluation, *Exploration, Ships, Drilling equipment, Oil industry, Mineral industry, International waters, Data collections, Safety.
Identifiers: Undersea apparatus, Offshore exploration.

An inventory (at the end of 1972) of equipment owned by U.S. companies and their foreign subsidiaries used for offshore petroleum and mineral exploration and exploitation is provided. Included are oceangoing mobile drilling units, support vessels (tugs, crew-boats, offshore supply vessels, geophysical vessels, pipe laying barges, and derrick barges), and special equipment (submersibles, saturation diving systems, deck decompression chambers, and underwater work chambers). Forecasts of offshore oil and gas production; number of wells drilled, mobile drilling unit and support vessel requirements, depth capability for drilling, diving, and pipe laying, and other industry trends are presented for the period 1972 to 2000. The study is for use in planning to meet the needs of growing offshore industries and the general public in the areas of search and rescue, commercial vessel safety, port safety, aids to navigation, and marine environmental protection. (Sinha-OEIS)
W76-03176

WATER MANAGEMENT IN ENGLAND: A REGIONAL MODEL,
North Carolina Univ. at Chapel Hill. Dept. of Environmental Sciences and Engineering.
D. A. Okun.
Environmental Science and Technology, Vol 9, No 10, p 918-923, October, 1975. 1 tab.

Descriptors: *Administration, *Water management(Applied), *Economics, Regional development, Rivers, Waste water treatment, Water supply, Effluents, Treatment facilities, Financing.
Identifiers: Regional Water Authorities(Great Britain).

The reorganization of water management in England, with its flexibility and cost-effectiveness, is contrasted with the situation in the United States. A history of water management developments in England over the past thirty years is presented. The key agencies of the 1973 Water Act reorganization are the 10 Regional Water Authorities (RWAs). These are based on hydrologic boundaries and optimize systems for all the communities they serve. Responsibilities of RWA headquarters include financing, planning, and water quality monitoring. Each of 152 multifunctional (water supply/rivers/waste water disposal) divisions within the RWAs is responsible for customer services, facilities operation, and design and construction of new facilities. In the United States, where each local authority is responsible for effluent discharges, the regulatory approach is a uniform effluent standard. This policy seems fair but is often uneconomical. In England, where there is a single ownership of all treatment facilities on a given river, an optimization model can indicate a least-cost solution for the entire region. Financing of water pollution control in the United States under the construction grants program (where construction costs are met by federal funds while operation and maintenance costs are met locally) has caused trends towards excessive construction and poor operation. In Great Britain, each water authority determines the construction for that region, (based on financial resources and need), optimizes total costs, and raise all its own funds. (Kramer-FIRL)
W76-03207

PRINCIPLES OF DETERMING A SOCIAL DISCOUNT RATE,
Rutgers-The State Univ., New Brunswick, N.J. Water Resources Research Inst.
For primary bibliographic entry see Field 6C.
W76-03263

RESEARCH NEEDS FOR WATER RESOURCES CONTROL IN CALIFORNIA.
California State Water Resources Control Board, Sacramento. Div. of Planning and Research.
For primary bibliographic entry see Field 5G.
W76-03265

EFFLUENT CHARGES, ENVIRONMENTAL QUALITY AND OTHER NATIONAL GOALS: A QUALIFICATION,
Pennsylvania State Univ., University Park. Center for the Study of Environmental Policy.
For primary bibliographic entry see Field 5G.
W76-03268

URBAN WATER USE IN AUSTRALIA,
Gutteridge, Haskins and Davey Pty. Ltd., Melbourne (Australia).
For primary bibliographic entry see Field 6D.
W76-03272

DEEPSEA MINERAL UTILIZATION, REGULATION AND ECONOMIC EFFICIENCY,
Delaware Univ., Newark. Dept. of Economics.
For primary bibliographic entry see Field 6C.
W76-03275

ECONOMIC ANALYSIS OF WHEAT PRODUCTION WITH FERTILIZER UNDER ADEQUATE AND LIMITING IRRIGATION WATER,
Central Arid Zone Research Inst., Jodhpur (India).
For primary bibliographic entry see Field 3F.
W76-03277

REALITY AND PROSPECTS OF THE FISHING INDUSTRY IN ITALY,
For primary bibliographic entry see Field 3E.
W76-03279

COMPARATIVE RIST-COST-BENEFIT STUDY OF ALTERNATIVE SOURCES OF ELECTRICAL ENERGY. APPENDIX A: ENERGY EXPENDITURES ASSOCIATED WITH ELECTRIC POWER PRODUCTION BY NUCLEAR AND FOSSIL FUELED POWER PLANTS.
Division of Reactor Research and Development (USERDA), Washington, D.C.
For sale by the Superintendent of Documents, U. S. Government Printing Office, Washington, D.C. 20402. Price $41.20. Report No. AEC WASH 1224-A, December 1974. 58 p, 9 fig, 32 tab, 22 ref.

Descriptors: *Electric power production, *Cost-benefit analysis, Efficiency, Energy, Nuclear powerplants, Fossil fuels, Energy conversion, Transportation, Mining, Waste disposal, Cooling towers, Power system operation, Transmission(Electrical).
Identifiers: Fossil fueled powerplants.

All energy expenditures in the energy production cycle, from mining fuel to the ultimate disposal of waste products are examined and compared between nuclear and fossil fueled electric generating plants. The energy used in each step of the production process per unit of net electrical energy are estimated. Production methods evaluated are Pressurized Water Reactor (PWR), Boiling Water Reactor (BWR), coal, oil, and natural gas electric plants. Heat energy is introduced into the system, including heat from the fuel in the energy producing process. Some of this energy is wasted as heat loss at the power plant, some as part of the necessary energy input to the process, and some as transmission loss. The balance goes as net energy to consumers. The study used a 1000-MWe net-full load generating plant in making the comparisons. Conclusions reached are: (1) Process heat requirements are very small compared to heat inputs and most heat loss occurs at power plant; (2) process electrical requirements are small except for light water reactors (LWR) which are of the order of 3% to 4% of plant output; (3) LWR reject significantly more heat at the plant; this, together with higher process electrical requirements, results in lower overall efficiency in LWR systems. (Carpenter-Wisconsin).
W76-03281

CHANGING WATER USE IN SELECTED MANUFACTURING INDUSTRIES,
National Bureau of Economic Research, Inc., Washington, D.C.
For primary bibliographic entry see Field 3E.
W76-03284

THE METROPOLITAN WATER DISTRICT OF SOUTHERN CALIFORNIA REPORT FOR THE FISCAL YEAR JULY 1, 1973 TO JUNE 30, 1974.
Southern California Metropolitan Water District, Los Angeles.
For primary bibliographic entry see Field 4A.
W76-03285

COLORADO RIVER AQUEDUCT OPERATION AND MAINTENANCE.
For primary bibliographic entry see Field 4A.
W76-03286

DISTRIBUTION SYSTEM OPERATION AND MAINTENANCE.
For primary bibliographic entry see Field 4A.
W76-03287

WATER TREATMENT.
For primary bibliographic entry see Field 4A.
W76-03288

ENGINEERING.
For primary bibliographic entry see Field 4A.
W76-03289

HYDROGRAPHY.
For primary bibliographic entry see Field 4A.
W76-03292

A STRATEGY FOR MANAGEMENT OF MARINE AND LAKE SYSTEMS WITHIN THE NATIONAL PARK SYSTEM.
National Park Service, Washington, D.C. Office of Natural Science.
For primary bibliographic entry see Field 2L.
W76-03296

BIBLIOGRAPHY OF WATER POLLUTION CONTROL BENEFITS AND COSTS,
Development Planning and Research Associates, Inc., Manhattan, Kans.
For primary bibliographic entry see Field 5G.
W76-03298

AESTHETIC RESOURCES OF THE COASTAL ZONE.
Mann (Roy) Associates, Inc., Cambridge, Mass.
For primary bibliographic entry see Field 2L.
W76-03419

6C. Cost Allocation, Cost Sharing, Pricing/Repayment

ECONOMIC EFFECTS OF LAND SUBSIDENCE DUE TO EXCESSIVE GROUNDWATER WITHDRAWAL IN THE TEXAS GULF COAST AREA,
Texas A and M Univ., College Station. Water Resources Inst.
For primary bibliographic entry see Field 4B.
W76-03099

DETERMINING OPTIMAL WELL DISCHARGE,
Colorado State Univ., Fort Collins.
For primary bibliographic entry see Field 4B.
W76-03118

REGIONAL DEVELOPMENT: AN ECONOMETRIC STUDY OF THE ROLE OF WATER DEVELOPMENT IN EFFECTUATING POPULATION AND INCOME CHANGES,
Utah Center for Water Resources Research, Logan.
For primary bibliographic entry see Field 6B.
W76-03137

DESIGN OF DRIP IRRIGATION MAIN LINES,
Hawaii Univ., Honolulu. Dept. of Agricultural Engineering.
For primary bibliographic entry see Field 8B.
W76-03160

OPTIMUM SIZE OF EQUIPMENT,
Construction Estimating, Inc., West Hartford, Conn.
For primary bibliographic entry see Field 8G.
W76-03161

INTERCEPTOR SEWER COST ANALYSIS,
Metropolitan Sanitary District of Greater Chicago, Ill. Sewer Design Section.
A. S. Paintal.
Water and Sewage Works, Vol 122, No 11, p 44, November, 1975.

Descriptors: *Sewerage, *Interceptor sewers, Costs, *Treatment facilities, Waste water treatment, Equations, Engineering, Capital costs, Waste water disposal, Sewers, Regression analysis, *Cost analysis.

An equation has been formulated to determine cost relationships for interceptor sewers, based on data gathered between 1963 and 1974 by the Metropolitan Sanitary District of Greater Chicago. Generalized cost equations for sewers do not exist. However, the cost of a sewage collection facility is approximately more than half of the capital cost of waste water disposal facilities. Cost relationships for interceptors can be expressed as: cost/mgd/mile=a(sewer capacity,mgd) to the bth power; cost/mile=c (sewer diameter) to the dth power; or cost/mile=e(service area population) to the fth power. The terms 'a', 'c', and 'e' are constants and 'b', 'd', and 'f' are power exponents, with sewer capacity expressed in mgd, sewer diameter in feet, and service area population in thousands. The data were analyzed to include construction costs only; legal and engineering fees as well as land acquisition and contingency costs were not included. Regression analysis of the data yielded the equations; cost $1000/mgd/mile=280(sewer capacity, mgd) to the -0.58th power and cost $1000/mile=250 (sewer diameter, feet) to the 1.13th power. These regression lines were plotted with the data. To develop the relationship between construction cost and service area population, it was assumed that the per capita sewage contribution was 100 gpd and that the peak to average sewage flow ratio x, is given by x=5/ p to the 1/6th power (P being the service area population in thousands). By combining the first equation with these assumptions, the following expression was derived: cost $1000/mile=209(service area population in 1000s) to the 0.35th power. (Kramer-FIRL)
W76-03194

DESIGN VALUE IN, WASTE OUT,
McKee-Berger-Mansueto, Inc., Washington, D.C.
For primary bibliographic entry see Field 5D.
W76-03205

PRINCIPLES OF DETERMING A SOCIAL DISCOUNT RATE,
Rutgers-The State Univ., New Brunswick, N.J. Water Resources Research Inst.
W. Whipple.
Water Resources Bulletin, Vol 11, No 4, p 811-819, 1975. 2 fig, 20 ref.

Descriptors: *Discount rates, *Government finance, *Risks, *Return(Monetary), *Depreciation, Project life, Amortization, Investment, Inflation, Social aspects.
Identifiers: Public investment, Private investment, Opportunity cost, Corporate income tax.

An examination of the principles suggested by the Water Resources Council in determining discount rates for government investment considers two approaches: The social opportunity cost and the subjective time preference. Generally government projects should yiled the same marginal return as is available in the private sector if there is to be an optimum allocation of society's resources. Government investments may have a lower net risk than private investment generally but this risk is not compensated in the yield on Federal bonds. Socially there seems no basis for regarding the higher but very variable private investment returns more favourably than the lower but much surer returns from Federal bonds. Protection of the interests of future generations is not a relavent consideration in comparing public discount rates to private rates of return. Private sector interest rates are high because of anticipated inflation, adding about 4%; such an item has no place in government discount rates. High corporate taxes mean high interest rates are necessary if reasonable after-tax returns are to be yielded; no such allowance should be made in public project discount rates. Present policy of the Water Resources Council may be overstating the required discount rate by about 3% (in 1975) given the present rate of inflation. (Carpenter-Wisconsin)
W76-03263

ECONOMIC ANALYSIS OF THE INLAND FISHERIES PROJECT IN EL SALVADOR,
Auburn Univ., Ala. International Center for Aquaculture.
For primary bibliographic entry see Field 6E.
W76-03264

RESIDUAL CHARGES AND PROFITS,
Pennsylvania State Univ., University Park. Center for the Study of Environmental Policy.
For primary bibliographic entry see Field 5G.
W76-03267

A SOCIOLOGICAL ASSESSMENT OF ECONOMIC INCENTIVES FOR INDUSTRIAL POLLUTION ABATEMENT,
Pennsylvania State Univ., University Park. Center for the Study of Environmental Policy.
For primary bibliographic entry see Field 5G.
W76-03269

FINANCIAL INCENTIVES AND POLLUTION CONTROL. A CASE STUDY,
Pennsylvania State Univ., University Park. Center for the Study of Environmental Policy.
For primary bibliographic entry see Field 5G.
W76-03270

DEEPSEA MINERAL UTILIZATION, REGULATION AND ECONOMIC EFFICIENCY,
Delaware Univ., Newark. Dept. of Economics.
L. G. Anderson.
Marine Technology Society Journal, Vol 9, No 4, p 17-19, 1975.

Descriptors: *Mining, *Oceans, Regulation, *Economic efficiency, Mineralogy, Exploitation, Equitable apportionment.
Identifiers: *Deepsea resources, Nodules, Free access.

Logue, Sweeney, and Petrou in discussing possible functions of an International Seabed Resources Authority concluded that free market production of deepsea minerals is necessary for efficiency. This may be true on efficiency grounds but it also depends on economic variables. Distribution and efficiency cannot be separated. Deepsea mineral exploitation of nodules does not fit the model, because there are no property rights to the sea floor and the small number of existing firms desiring and capable of deepsea production encourages behavior closer to monopolistic than competitive. A strong regulatory agency may be required, to achieve proper intertemporal use of deepsea minerals. Economic theory alone cannot provide enough information to determine if an efficient free-access free-timing system with possible property rights and monopoly problems or a regulated system with positive regulation expenses and the possibility of political objectives as the primary goal is preferred on efficiency grounds. Distributional aspects must also be considered. The scheme best for the United States may not be best for other countries. Choice of the proper regime for deepsea utilization of mineral resources is not simple, even considering economic efficiency alone when distribution or equity are involved. (Buchanan-Davidson--Wisconsin)
W76-03275

ECONOMIC ASPECTS OF GEOELECTRICAL PROSPECTING IN SANDSTONE AQUIFERS,
Birmingham Univ. (England). Dept. of Geological Sciences.
For primary bibliographic entry see Field 4B.
W76-03276

HOUSEHOLD TECHNOLOGY AND THE DOMESTIC DEMAND FOR WATER,
National Institute of Economic and Social Research, London (England).
For primary bibliographic entry see Field 6D.
W76-03278

THE METROPOLITAN WATER DISTRICT OF SOUTHERN CALIFORNIA REPORT FOR THE FISCAL YEAR JULY 1, 1973 TO JUNE 30, 1974.
Southern California Metropolitan Water District, Los Angeles.
For primary bibliographic entry see Field 4A.
W76-03285

STATE WATER PROJECT.
For primary bibliographic entry see Field 4A.
W76-03290

CONSTRUCTION.
For primary bibliographic entry see Field 4A.
W76-03291

PURCHASING, PERSONNEL, AND RIGHT OF WAY.
For primary bibliographic entry see Field 4A.
W76-03294

FINANCING.
For primary bibliographic entry see Field 4A.
W76-03295

ENVIRONMENTAL CLEANUP 1975-1985: HUGE NEW COSTS,
For primary bibliographic entry see Field 5G.
W76-03322

ASPECTS OF WATERWORKS PUMPING PLANT DESIGN,
For primary bibliographic entry see Field 8C.
W76-03324

PROBLEMS IN SMALL WATER SYSTEMS,
North Carolina Dept. of Human Resources, Raleigh. Div. of Health Services.
For primary bibliographic entry see Field 5F.
W76-03432

FINANCIAL CONSIDERATIONS FOR RURAL WATER SYSTEMS,
Farmers Home Administration, Washington, D.C.
For primary bibliographic entry see Field 5F.
W76-03433

WATER RATES: AN ASSESSMENT OF CURRENT ISSUES,
Johns Hopkins Univ., Baltimore, Md.
For primary bibliographic entry see Field 5F.
W76-03439

6D. Water Demand

ENERGY DEMAND AND WATER RESOURCE MANAGEMENT: SOME ECONOMIC ASPECTS,
New York State Coll. of Agriculture and Life Sciences, Ithaca. Dept. of Agricultural Economics.
D. K. Lyon.
Available from the National Technical Information Service, Springfield, Va 22161 as PB-248 456, $6.00 in paper copy, $2.25 in microfiche. Completion Report, No A E Res 75-32, December 1975. 124 p, 26 tab, 6 fig. OWRT B-045-NY(1). 14-31-0001-5096.

Descriptors: *Water resources, *Management, *Energy, *Demand, *Economics, River basins, Electric power industry, Water allocation(Policy), Optimization, Powerplants, Cooling, Mathematical models, Systems analysis.
Identifiers: *Susquehanna River basin, Cost minimization, Mixed-integer programming, Water withdrawal.

A general economic model is developed which uses mixed-integer programming to minimize the cost of water withdrawals to the electricity generating industry. The model is placed in the context of a river basin and indicates the amount of water to be allocated for power plant cooling systems, given an exogenously determined level of electricity demand. The model is applied to a study region, the Susquehanna River Basin. Several parameters affecting the model results are tested. Among those tested in the analysis are various electricity forecast scenarios, withdrawal level policy and thermal regulations. The model may be expanded in order to analyze other policies and to include other sectors in the objective function, in addition to the electricity industry. (Kalter-Cornell)
W76-03003

URBAN WATER USE IN AUSTRALIA,
Gutteridge, Haskins and Davey Pty. Ltd., Melbourne (Australia).
C. R. Weeks, I. E. Aust, T. A. McMahon, and M. I. Aust.
Institution of Engineers, Australia, Civil Engineering Transactions, Vol 16, No 1, p 58-66, 1974. 6 fig, 10 tab, 41 ref.

Descriptors: *Australia, *Water utilization, *Cities, Water demand, Forecasting, Industrial water, Domestic water, Use rates.
Identifiers: Multivariate analysis, Household water use, Garden watering.

Water use data, considered useful to design engineers concerned with urban water supply systems is presented. The project was primarily developed to evaluate factors affecting residential and industrial water use in Australia and data from 14 Australian cities was collated and analysed. Part I examines factors influencing annual urban water use and its seasonal variations. These factors include population size, metering, water quality, and climate effects. Water demands for 1985 are predicted for 11 Australian cities, using trend extrapolation. Monthly consumption and climatic variables are related through multivariate analysis. Part II provides residential usage based on five small study areas. These results are used to detail characteristics of household and garden water usage. Part III discusses characteristics of industrial water use in Melbourne. Water use per unit of production for 29 processes is tabulated. (Carpenter-Wisconsin)
W76-03272

HOUSEHOLD TECHNOLOGY AND THE DOMESTIC DEMAND FOR WATER,
National Institute of Economic and Social Research, London (England).
R. A. Batchelor.
Land Economics, Vol 51, No 3, p 208-223, 1975. 3 fig, 3 tab, 23 ref.

Descriptors: *Water demand, *Forecasting, *Domestic water, Pricing, Econometrics, Water rates, Elasticity of demand, Water utilization, Model studies, Europe.
Identifiers: Metering of water, England.

Traditionally the demand for household water in the United Kingdom has been met in full without any use of restrictions via a charge based on use of water. Changind conditions due to rapid economic growth and anticipated costs of new water supply projects require a new approach. Metering is now being actively considered as an option. This study examines the impact of metering of water usage on the household consumption by estimating a demand function for water usage by an econometric study of household demand for water in Melvern, England, the only place where water is presently metered. The models uses the 'new' theory based on the 'characteristics' of the good demanded. The idea that water demand may be significantly influeced by variations in household technology based on income, is the central theme of the study. The identifying technological changes are the introduction of water-using appliances into activities which were previously either manual (clothes and dish washing, etc.) and wholly external to the household (transport). A dynamic characteristic of water demand--the tendency for wealth elasticities to rise as washing machines and cars are accumulated--is pretinent to the metering decision. (Carpenter-Wisconsin)
W76-03278

COMPUTER PRINT-OUT SHEETS. USER'S MANUAL, INTEGRATED AMMONIA MODEL.
Houston Univ., Tex.
For primary bibliographic entry see Field 5D.
W76-03282

AN APPLICATION OF DISCRIMINANT ANALYSIS TO DETERMINE THE DEMAND FOR INDUSTRIAL FLOOD PLAIN LOCATION,
Missouri Univ., St. Louis. School of Business Administration.
For primary bibliographic entry see Field 6F.
W76-03283

CHANGING WATER USE IN SELECTED MANUFACTURING INDUSTRIES,
National Bureau of Economic Research, Inc., Washington, D.C.
For primary bibliographic entry see Field 3E.
W76-03284

WATER RESOURCES OF WEST-CENTRAL MISSOURI,
Geological Survey, Rollo, Mo.
For primary bibliographic entry see Field 7C.
W76-03401

TECHNIQUES FOR WATER DEMAND ANALYSIS AND FORECASTING: PUERTO RICO, A CASE STUDY,
Geological Survey, Reston, Va.
E. D. Attanasi, E. R. Close, and M. A. Lopez.
Open-file report 75-94, 1975. 76 p, 1 fig, 17 tab, 36 ref, append.

Descriptors: *Water demand, *Water resources development, *Water supply, *Puerto Rico, *Forecasting, Model studies, Systems analysis, Analytical techniques, Water users, Water utilization, Planning.

The rapid economic growth of the Commonwealth of Puerto Rico since 1947 has brought public pressure on Government agencies for rapid development of public water supply and waste treatment facilities. This report is part of a 2-year cooperative study by the U.S. Geological Survey and the Environmental Quality Board of the Commonwealth of Puerto Rico, for the development of systems analysis techniques for use in water resources planning. The report reviews the institutional structure associated with water resources planning for the Commonwealth. A brief description of alternative water demand forecasting procedures is presented and specific techniques and analyses of Puerto Rico demand data are discussed. Models provide a framework for making several sets of water demand forecasts based on alternative economic and demographic assumptions. The historical impact of water resources investment on regional economic development is analyzed and related to water demand forecasting. (Woodard-USGS)
W76-03407

WATER DEMAND FORECASTING--SOME CONCEPTS AND TECHNIQUES,
North Carolina Univ., Chapel Hill. Dept. of Environmental Sciences and Engineering.
For primary bibliographic entry see Field 5F.
W76-03442

6E. Water Law and Institutions

WATER SUPPLIES FOR LOW-INCOME COMMUNITIES IN DEVELOPING COUNTRIES,
Birmingham Univ. (England). Dept. of Civil Engineering.
For primary bibliographic entry see Field 5F.
W76-03114

WATER MANAGEMENT IN ENGLAND: A REGIONAL MODEL,
North Carolina Univ. at Chapel Hill. Dept. of Environmental Sciences and Engineering.
For primary bibliographic entry see Field 6B.
W76-03207

PRIVATE CONSTRAINTS ON GROUNDWATER CONTAMINATION,
Virginia Polytechnic Inst. and State Univ., Blacksburg. Water Resources Research Center.
For primary bibliographic entry see Field 4B.

W76-03244

CAN WE AFFORD ZERO POLLUTION RISK,
Texas Univ. at Austin. Dept. of Civil Engineering.
For primary bibliographic entry see Field 5G.
W76-03249

ECONOMIC ANALYSIS OF THE INLAND FISHERIES PROJECT IN EL SALVADOR,
Auburn Univ., Ala. International Center for Aquaculture.
E. W. McCoy.
Project A.I.D./la-688, January 1974. 50 p, 8 fig, 4 tab, 13 ref.

Descriptors: *Aquiculture, *Foreign countries, *Economic impact, Marketing, Pricing, Human resources, Diets, Productivity, Freshwater fish, Evaluation, Lake fisheries, Return(Monetary), Fish harvest, Tilapia, Employment, Fish farming.
Identifiers: *El Salvador, *Inland Fisheries Project, Aid for International Development.

The accomplishments and potential of an Aid for International Development inland fisheries project in El Salvador are described. Over a two year period, a Fisheries Station at Santa Cruz Porrilo was completed together with a survey of lakes, ponds, and farm pond culture. Research into the possibility of increasing harvests from the national waters of El Salvador was conducted, community ponds developed, the Fisheries Service expanded and an active program of dissemination fisheries information to prospective fish farmers instituted. Fish marketing methods are detailed. Two major problems still exist: Lack of funds which severely limits developments and construction; a shortage of trained personnel. However, prospects of the impact of the Fisheries Project are encouraging: (1) A number of individuals are at present undergoing technical training; (2) favourable climatic conditions in El Salvador, with an assured water supply and a polyculture system utilizing supplementary feeding promise very high production levels; (3) multiple-pond developers will require wells thus enhancing the domestic water supply. Full-time employment coupled with a higher protein diet may help to improve the educational level of a proportion of the population. Intensive fish culture represents one means to supply the maximum return of protein for high population density and limited land resources. (Carpenter-Wisconsin)
W76-03264

ENVIRONMENT LAWS MAY CLOSE MANY USA FISH FACTORIES.
For primary bibliographic entry see Field 5G.
W76-03273

STATE WATER PROJECT.
For primary bibliographic entry see Field 4A.
W76-03290

LEGAL.
For primary bibliographic entry see Field 4A.
W76-03293

SUMMARY, FINAL REPORT 1975, OREGON COASTAL CONSERVATION AND DEVELOPMENT COMMISSION.
For primary bibliographic entry see Field 2L.
W76-03418

THE PROCEEDINGS OF A NATIONAL SYMPOSIUM ON THE STATE OF AMERICA'S DRINKING WATER.
North Carolina Water Resources Research Inst., Raleigh.
For primary bibliographic entry see Field 5F.
W76-03422

IMPACT OF THE SAFE DRINKING WATER ACT,
Environmental Protection Agency, Washington, D.C. Office of Water Supply.
For primary bibliographic entry see Field 5F.
W76-03423

THE DEVELOPMENT AND APPLICATION OF THE 1974 DRINKING WATER STANDARDS,
Environmental Protection Agency, Washington, D.C. Office of Water Supply.
For primary bibliographic entry see Field 5F.
W76-03424

EPIDEMIOLOGY OF WATERBORNE DISEASE IN THE UNITED STATES 1971-1973,
Center for Disease Control, Atlanta, Ga. Bureau of Epidemiology.
For primary bibliographic entry see Field 5F.
W76-03426

EVALUATING STATE DRINKING WATER QUALITY SURVEILLANCE PROGRAMS,
Environmental Protection Agency, Atlanta, Ga. Region IV.
For primary bibliographic entry see Field 5F.
W76-03430

LEGAL CONTROLS FOR PROTECTING UNDERGROUND SOURCES OF DRINKING WATER,
Virginia Polytechnic Inst. and State Univ., Blacksburg. Water Resources Research Center.
For primary bibliographic entry see Field 5F.
W76-03435

AN APPROACH TO PROVISION OF RURAL WATER SUPPLIES,
Conset, Inc., Washington, D.C. National Demonstration Water Project.
For primary bibliographic entry see Field 5F.
W76-03437

TRAINING OPPORTUNITIES AND THE SAFE DRINKING WATER ACT,
Greensboro Public Works, N.C.
For primary bibliographic entry see Field 5F.
W76-03440

6F. Nonstructural Alternatives

TWO DECADES OF FLOOD-PLAIN MANAGEMENT: THE TVA REGIONAL EXPERIENCE,
Tennessee Valley Authority, Knoxville. Local Flood Relations.
G. R. Wall.
In: Virginia Polytechnic Institute and State University, Blacksburg, Extension Division Publication No 629, p 91-97, 1974.

Descriptors: *Flood plains, *Urbanization, *Flood damage, *Tennessee Valley Authority, Decision making, Management, Flood control, Land use.

The evolution of the Tennessee Valley Authority's Local Flood Relations Program for flood control is described. Major elements of the approach are in organizing various citizens groups and in preparing codes and ordinances including flood plain regulations. Structural measures are used in non-tradiational ways to bring about other actions. In all cases, flood plain regulations are essential elements. The program has demonstrated that flood damages can be reduced markedly by cooperative action. This is not done by either eliminating all uses of the flood plain or by eliminating floods. Rather it is accomplished by using a variety of closely coordinated elements. Effective federal-state-local cooperative programs permit each level of action to complement the others. The use of prudent planning is emphasized and a planning outline process used effectively in the Tennessee Valley is one derived from a problem-solving technique. The stepts involved are: (1) Recognize the problem; (2) define the problem; (3) enumerate alternatives; (4) evaluate limitations and disadvantges; (5) search for modifications; (6) reevaluate limitations and disadvantages; (7) narrow alternatives; (8) decide on solutions; and (9) take action. The point made is that flood plains should be used--but for a purpose compatible with local, regional, and national objectives. (Auen-Wisconsin)
W76-03271

AN APPLICATION OF DISCRIMINANT ANALYSIS TO DETERMINE THE DEMAND FOR INDUSTRIAL FLOOD PLAIN LOCATION,
Missouri Univ., St. Louis. School of Business Administration.
A. Corbeau, and C. F. Meyer.
Available from the National Technical Information Service, Springfield, Va 22161. Army Engineer Institute for Water Resources Report No IWR 74-P8, December 1974. 55 p, 34 ref, 2 append. DACW 73-73-C-0044.

Descriptors: *Flood plains, Analytical techniques, *Industries, *Locating, Risk, Sites, Attitudes, Motivation, Flood frequency.
Identifiers: Factor analysis, Discriminant analysis, St. Louis(Mo).

To identify the factors which motivate firms to locate on flood plains data on the characteristics of manufacturing and commercial firms in the St. Louis area were gathered and analyzed to determine and quantify statistical differences between firms located on and off flood plains. The research was divided into four major areas: (1) Data collection: three hundred firms were interviewed and information on sales, shipping costs, employee costs, and size of site were compiled; (2) isolation of potential classification variables, using the statistical technique of factor analysis; (3) determination of classification functions (which included flood risk) to decide if a firm was either off or on a flood plain; and (4) simulation of these functions to determine the effect of flood risk on location decisions. The principal finding of this effort is that there is significant statistical difference between both manufacturing and commercial firms located on and off flood plains. The difficulty encountered during the simulation phase of the study was due to the nature of the flood risk data. By attempting to quantify flood hazard by the use of flood frequencies, an arbitrary but constant characteristic was required to be imposed on the off flood plain observations. (Carpenter-Wisconsin).
W76-03283

FLOOD PLAIN INFORMATION: PETERS CREEK, BIRCHWOOD, ALASKA.
Army Engineer District, Anchorage, Alaska.
For primary bibliographic entry see Field 4A.
W76-03454

FLOOD PLAIN INFORMATION: SOUTHEAST STREAM GROUP, STOCKTON, CALIFORNIA.
Army Engineer District, Sacramento , Calif.
For primary bibliographic entry see Field 4A.
W76-03455

FLOOD PLAIN INFORMATION: WILDCAT CREEK, MANHATTAN, KANSAS.
Army Engineer District, Kansas City, Kans.
For primary bibliographic entry see Field 4A.
W76-03456

FLOOD PLAIN INFORMATION: ROARING BROOK, AVON, CONNECTICUT.
Army Engineer District, Waltham, Mass.
For primary bibliographic entry see Field 4A.
W76-03457

FLOOD PLAIN INFORMATION: ESCONDIDO CREEK, SAN DIEGO COUNTY, CALIFORNIA.
Army Engineer District, Los Angeles, Calif.
For primary bibliographic entry see Field 4A.
W76-03458

FLOOD PLAIN INFORMATION: RILLITO RIVER AND PANTANO WASH, VICINITY OF TUCSON, ARIZONA.
Army Engineer District, Los Angeles, Calif.
For primary bibliographic entry see Field 4A.
W76-03459

FLOOD PLAIN INFORMATION: BIG CREEK, LOST CREEK, CHRISTIAN CREEK AND WHITEMAN'S CREEK, JONESBORO, ARKANSAS.
Army Engineer District, Memphis, Tenn.
For primary bibliographic entry see Field 4A.
W76-03460

SPECIAL FLOOD HAZARD INFORMATION REPORT: BEAR CREEK, DENVER METROPOLITAN AREA.
Army Engineer District, Omaha, Nebr.
For primary bibliographic entry see Field 4A.
W76-03461

FLOOD PLAIN INFORMATION: CACHE LA POUDRE RIVER, COLORADO, VOLUME II, GREELEY, WELD COUNTY.
Corps of Engineers, Omaha, Nebr.
For primary bibliographic entry see Field 4A.
W76-03462

6G. Ecologic Impact Of Water Development

DIVERSITY AND OVERLAP AS MEASURES OF ENVIRONMENTAL QUALITY,
Woods Hole Oceanographic Institution, Mass.
R. L. Haedrich.
Water Research, Vol 9, p 945-952, 1975. 6 fig, 1 tab, 55 ref.

Descriptors: *Environmental effects, *Life cycles, Seasonal, Population, Methodology, *Massachusetts, Bays, Estuaries.
Identifiers: *Diversity, *Overlap, *Environmental quality, Environmental impact statements.

Using the indices of diversity (H) and overlap (PS) together was suggested to assess environmental quality. The method was tested using data on demersal fishes from Massachusetts estuaries and embayments. Annual diversity ranged from H (loge)=0.4-2.4 with low diversities in areas of apparent high pollution and higher diversities in areas of lesser pollution. Where annual diversity was low, little seasonal change was reflected in a high PS from season to season; where annual diversity was high, a relatively lower PS indicated a greater degree of change. This data was suggested for use in environmental impact statements. (Klein)
W76-03024

LONG-TERM EFFECTS OF 4-AMINOPYRIDINE EXPOSURE TO BIRDS AND FISH,
Bureau of Sport Fisheries and Wildlife, Denver, Colo. Denver Wildlife Research Center.
For primary bibliographic entry see Field 5C.
W76-03043

ECOLOGY, ECONOMY AND MINING IN VERMONT,
For primary bibliographic entry see Field 5G.
W76-03061

UNCONVENTIONAL NUCLEAR POWER PLANT SITING OPTIONS AND WATER RESOURCE IMPACTS,
Connecticut Univ., Storrs. Inst. of Water Resources.
For primary bibliographic entry see Field 5G.
W76-03135

PHYSICAL, CHEMICAL, AND BIOLOGICAL CHARACTERISTICS OF NEARSHORE ZONE OF SAND KEY, FLORIDA, PRIOR TO BEACH RESTORATION. VOLUME I,
National Marine Fisheries Service, Panama City, Fla. Gulf Coastal Fisheries Center.
For primary bibliographic entry see Field 2L.
W76-03177

OPTIMAL POLLUTION CONTROL WITH A NONCONSTANT EXPONENTIAL RATE OF DECAY,
Guelph Univ., (Ontario). Dept. of Economics.
For primary bibliographic entry see Field 5G.
W76-03206

ENVIRONMENTAL CLEANUP 1975-1985: HUGE NEW COSTS,
For primary bibliographic entry see Field 5G.
W76-03322

WATER AND THE SOUTH FLORIDA ENVIRONMENT,
Geological Survey, Miami, Fla.
For primary bibliographic entry see Field 5C.
W76-03402

REPORT ON ENVIRONMENTAL STUDY INTO THOMSON DAM AND ASSOCIATED WORKS.
Melbourne and Metropolitan Board of Works (Australia).
Report No. MMBW-W0051, July 1975. 2 vol, 296 p, 21 fig, 13 append.

Descriptors: *Environmental effects, *Reservoir construction, *Australia, Dams, Water supply, Ecology, Habitats, Land use, Recreation, Watersheds(Basins), River regulation, Water quality, Watershed management, Water yield, *Water supply development, Pre-impoundment.
Identifiers: *Environmental impact statements, Thomson River(Vic.), Lower Yarra River(Vic.), Melbourne(Vic.).

The proposed Thomson Dam construction is the third stage in development of the Thomson and Lower Yarra catchments for augmenting water supplies for metropolitan Melbourne (Australia). An environmental impact study is reported in two parts (corresponding to Volumes 1 and 2 respectively): a description of the proposed works with a survey of the existing physical, biological and social features of the area; and estimates of the environmental implications of the works when established. Factors considered in the second part include streamflow and water quality; vegetation, habitat and wildlife effects; and implications for primary production, recreation and tourism in the area. Some further studies necessary to ensure effective use of the development are outlined. (CSIRO)
W76-03448

7. RESOURCES DATA

7A. Network Design

U.S. IFYGL SHIPBOARD DATA ACQUISITION SYSTEM,
International Field Year for the Great Lakes Project Office, Rockville, Md.
For primary bibliographic entry see Field 2H.
W76-03416

7B. Data Acquisition

WINTER SOIL WATER DYNAMICS,
Alaska Univ., College. Inst. of Water Resources.
For primary bibliographic entry see Field 2G.
W76-03002

WATER QUALITY IN IOWA STREAMS: SUMMARY OF A CONFERENCE HELD MARCH 1975.
Iowa State Univ., Ames. Dept. of Animal Ecology.
For primary bibliographic entry see Field 5A.
W76-03004

METHOD AND APPARATUS FOR DETECTING THE DEGREE OF CONTAMINATION OF WASTE WATER,
Katsuhiki Hayashi, Tokyo (Japan). (Assignee).
For primary bibliographic entry see Field 5A.
W76-03014

IMPROVED FLOWING WATER APPARATUS FOR THE CULTURE OF BRACHYURAN CRAB LARVAE,
Oregon State Univ., Newport. Marine Science Center.
For primary bibliographic entry see Field 5A.
W76-03035

APPARATUS FOR CONTINUOUSLY SATURATING WATER WITH HYDROPHOBIC ORGANIC CHEMICALS,
National Water Quality Lab., Duluth, Minn.
For primary bibliographic entry see Field 5A.
W76-03047

METHOD OF ESTIMATING MAXIMUM WATER-HOLDING CAPACITY IN SHALLOW SOIL IN A WATERSHED BY PORTABLE SEISMIC PROSPECTING EQUIPMENT,
For primary bibliographic entry see Field 2G.
W76-03063

A LABORATORY INVESTIGATION OF THE EFFECT OF SURFACE FILMS ON WIND INDUCED REAERATION,
Massachusetts Univ., Amherst. Water Resources Research Center.
For primary bibliographic entry see Field 5B.
W76-03100

FLUOMETURON AND WATER CONTENT DISTRIBUTIONS DURING INFILTRATION: MEASURED AND CALCULATED,
Oklahoma State Univ., Stillwater. Dept. of Agronomy.
For primary bibliographic entry see Field 5B.
W76-03123

TREES AS ENVIRONMENTAL SENSORS MONITORING LONG-TERM HEAVY METAL CONTAMINATION OF SPOKANE RIVER, IDAHO,
Washington State Univ., Pullman. Dept. of Chemical and Nuclear Engineering.
For primary bibliographic entry see Field 5A.
W76-03320

APPLICATION OF REMOTE-SENSING TECHNIQUES TO THE STUDY OF SEASONAL SNOW COVER,
Geological Survey, Tacoma, Wash.
For primary bibliographic entry see Field 2C.
W76-03389

GLACIER APPLICATIONS OF ERTS IMAGERY,
Geological Survey, Tacoma, Wash.

For primary bibliographic entry see Field 2C.
W76-03390

NEW WAYS TO MONITOR THE MASS AND AREAL EXTENT OF SNOW COVER,
Geological Survey, Tacoma, Wash.
For primary bibliographic entry see Field 2C.
W76-03391

A LEVER-OPERATED EKMAN GRAB,
Glasgow Univ. (Scotland). Field Station.
H. D. Slack.
Freshwater Biol, Vol 2, No 4, p 401-405, 1972, Illus.

Descriptors: *Sampling, Monitoring, Equipment, Instrumentation.
Identifiers: *Ekman Grab.

A new type of Ekman Grab is described in which the need for a messenger weight is eliminated, improving its operation under non-static conditions.--Copyright 1973, Biological Abstracts, Inc.
W76-03392

A WATER CONDUCTIVITY RECORDER,
Commonwealth Scientific and Industrial Research Organization, Clayton (Australia). Div. of Chemical Physics.
For primary bibliographic entry see Field 5A.
W76-03453

ION-SELECTIVE ELECTRODES IN ENVIRONMENTAL RESEARCH,
Missouri Univ., Columbia. Dept. of Chemistry.
For primary bibliographic entry see Field 5A.
W76-03499

THE APPLICATION OF SEMICONDUCTOR COMPOUNDS AS INDICATOR ELECTRODES,
Skopje Univ. (Yugoslavia). Center for Radioisotopes Application in Science and Industry.
For primary bibliographic entry see Field 5A.
W76-03500

7C. Evaluation, Processing and Publication

SOUTH PLATTE RIVER FLOW CORRELATIONS,
Colorado State Univ., Fort Collins. Dept. of Civil Engineering.
For primary bibliographic entry see Field 4B.
W76-03117

A STOCHASTIC-CONCEPTUAL ANALYSIS OF ONE-DIMENSIONAL GROUNDWATER FLOW IN NONUNIFORM HOMOGENEOUS MEDIA,
British Columbia Univ., Vancouver. Dept. of Geological Sciences.
For primary bibliographic entry see Field 2F.
W76-03128

USE OF RISK PREMIUMS IN CHANCE-CONSTRAINED DYNAMIC PROGRAMING,
New South Wales Univ., Kensington (Australia). School of Civil Engineering.
For primary bibliographic entry see Field 6A.
W76-03166

DAILY AND WEEKLY UPWELLING INDICES, WEST COAST OF NORTH AMERICA, 1967-73.
National Marine Fisheries Service, Monterey, Calif. Pacific Environmental Group.
For primary bibliographic entry see Field 2L.
W76-03179

ANNOTATED BIBLIOGRAPHY OF NOAA PUBLICATIONS OF HYDROMETEOROLOGICAL INTEREST,
National Oceanic and Atmospheric Administration, Washington, D.C.
For primary bibliographic entry see Field 2B.
W76-03183

SURFACE WAVE DATA RECORDED IN LAKE ONTARIO DURING IFYGL,
National Oceanic and Atmospheric Administration, Ann Arbor, Mich. Great Lakes Environmental Research Lab.
P. C. Liu, and T. A. Kessenich.
NOAA Technical Memorandum ERL GLERL-2, March 1975. 197 p, 1 fig, 1 tab, 3 ref, 4 append.

Descriptors: *Lake Ontario, *Waves(Water), *Ocean waves, Surface waters, Great Lakes, Hydrography, Hydrology, Currents(Water), Wavelengths, Tides, *Data collections.
Identifiers: Surface waves, *Surface wave data, Wave statistics, *Wave data analysis, Wave recordings, Waverider buoys, Wave heights, Wave periods, Lake currents.

This report presents surface wave data recorded by the four waverider buoys deployed along the main axis of Lake Ontario during 1972. The presentation is given in the form of daily summaries of hourly wave statistics generated from a computerized wave data analysis system. In addition to providing systematic information on Lake Ontario surface waves, this report can also be used as an index to digitized wave data for further studies. (NOAA)
W76-03184

NEW YORK BIGHT PROJECT, WATER COLUMN SAMPLING CRUISES NO 1-5 OF THE NOAA SHIP FERREL, AUGUST-NOVEMBER 1973,
National Oceanic and Atmospheric Administration, Boulder, Colo. Marine Ecosystems Analysis Program Office.
J. B. Hazelworth, B. L. Kolitz, R. B. Starr, R. Charnell, and G. A. Berverian.
Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402. MESA Report No 74-2, July 1974. 191 p, 1 fig, 1 tab, 8 ref.

Descriptors: *Currents(Water), *Water circulation, *Ocean circulation, *Current meters, Flow measurement, Cruises, *Water sampling, Turbidity, Water temperature, Salinity, Water quality, New York, *Data collections, Measurement, Nutrients.
Identifiers: *New York Bight, Water column sampling, Oceanographic cruises, Marine ecosystem, Physical oceanographic data, Nutrient data.

During the period August - November 1973, a series of five oceanographic cruises were made by the NOAA ship Ferrel in the New York Bight. These cruises aare the first in a series of monthly cruises scheduled to last through 1975. Emphasis was given to collecting physical, chemical, and geological data. The objective of the cruises was to supply data to base analysis of the water movements on the highly impacted ecosystem. This report presents the corrected data from these five cruises and describes the parameters measured, the measurements methods, and correction applied to the data. (NOAA)
W76-03187

CHEMICAL TREATMENT FOR PHOSPHATE CONTROL,
California Univ., Berkeley. Div. of Hydraulic and Sanitary Engineering.
For primary bibliographic entry see Field 5D.
W76-03242

COMPUTER PRINT-OUT SHEETS. USER'S MANUAL, INTEGRATED AMMONIA MODEL.
Houston Univ., Tex.
For primary bibliographic entry see Field 5D.
W76-03282

STUDIES OF SELECTED PRECIPITATION CASES FROM METROMEX.
Illinois State Water Survey, Urbana.
For primary bibliographic entry see Field 2B.
W76-03353

SECULAR CHANGES IN SOUTH AFRICA RAINFALL: 1880 TO 1972,
University of the Witwatersrand, Johannesburg (South Africa).
For primary bibliographic entry see Field 2B.
W76-03367

THE ASSIGNMENT OF RAINFALL STATIONS INTO HOMOGENEOUS GROUPS: AN APPLICATION OF PRINCIPAL COMPONENT ANALYSIS,
University of the Witwatersrand, Johannesburg (South Africa). Dept. of Applied Mathematics.
For primary bibliographic entry see Field 2B.
W76-03368

OPTIMAL IDENTIFICATION OF PARAMETERS IN AN INHOMOGENEOUS MEDIUM WITH QUADRATIC PROGRAMMING,
California Univ., Los Angeles.
For primary bibliographic entry see Field 2F.
W76-03369

WATER QUALITY,
Geological Survey, Menlo Park, Calif.
For primary bibliographic entry see Field 5B.
W76-03395

MAP OF THE ANTELOPE VALLEY-EAST KERN WATER AGENCY AREA, CALIFORNIA, SHOWING GROUND-WATER SUBUNITS AND AREAS, LOCATION OF WELLS, AND WATER-LEVEL CONTOURS FOR SPRING 1975,
Geological Survey, Garden Grove, Calif.
J. H. Koehler.
Open-file map, 1975, 1 sheet.

Descriptors: *Maps, *Water levels, *Groundwater, *Water wells, *California, Aquifers, Contours, Seasonal, Spring, Hydrologic data.
Identifiers: *Antelope Valley(Calif).

This map of the Antelope Valley-East Kern Water Agency area, California, shows groundwater subunits and areas, location of wells, and water level contours for spring 1975. The water-level contour intervals are 10, 25, 50, and 100 feet. Datum is mean sea level. (Woodard-USGS)
W76-03396

HURRICANE AGNES RAINFALL AND FLOODS, JUNE-JULY 1972,
Geological Survey, Reston, Va; and National Weather Service, Silver Spring, Md.
For primary bibliographic entry see Field 2E.
W76-03397

MAP SHOWING GROUND-WATER CONDITIONS IN THE WATERMAN WASH AREA, MARICOPA AND PINAL COUNTIES, ARIZONA--1975,
Geological Survey, Phoenix, Ariz.
E. E. Denis.
Arizona Water Commission, Phoenix, Hydrologic Map Series Map H-1, August 1975. 3 sheets.

Descriptors: *Groundwater resources, *Aquifers, *Water levels, *Water quality, *Arizona, *Maps, Hydrologic data, Water wells, Hydrogeology, Specific conductivity, Fluorides.
Identifiers: Waterman Wash area(Ariz).

Three maps showing groundwater conditions in the Waterman Wash area, Arizona--1975, include (1) specific conductance and fluoride concentration, (2) depth to water, well depth, and altitude of the water table, and (3) change in water level, 1966-75, and irrigated area. In the area the annual average maximum daily air temperature is about 88 deg F, and the optimum concentration of fluoride in drinking water is 0.7 mg/litre. About the upper 600 ft of alluvium is composed of poorly consolidated silt, sand, and gravel interbedded with many clay layers; below about 600 ft and to a depth of at least 1,600 ft, the alluvium is composed of semiconsolidated sand and gravel and contains very little clay. Groundwater occurs under water-table conditions in most of the area. The withdrawal of groundwater has resulted in a general decline in water levels. Water-level declines in measured wells for 1952-75 ranged from nearly 172 ft to less than 8 ft. (Woodard-USGS)
W76-03399

INDEX OF SURFACE WATER QUALITY RECORDS TO SEPTEMBER 30, 1973, SOUTHEAST ALASKA,
Geological Survey, Anchorage, Alaska.
P. J. Still.
Open-file report (Basic Data), 1975. 19 ref, 1 fig, 1 tab.

Descriptors: *Water quality, *Surface waters, *Alaska, Indexing, Basic data collections, Chemical analysis, Sampling, Sites, *Maps, Documentation, Information retrieval.
Identifiers: Southeast Alaska, Surface water quality index.

The U.S. Geological Survey has collected and analyzed water-quality samples from surface waters of the State of Alaska since 1949. This report lists all sites in southeast Alaska for which water-quality data are available and the types of data which have been collected. The location of sampling sites is shown on a map (scale: 1 inch equals about 26.7 kilometres). All of the data listed in this index can be retrieved in tabular form. Retrieval can be made for individual stations or for series of stations by station number or in latitude-longitude sequence. Questions regarding costs or procedures for computer retrieval or other information regarding the data listed in this index should be addressed to: District Chief, U. S. Geological Survey, Water Resources Division, 218 E Street, Anchorage, Alaska 99501. (Woodard-USGS)
W76-03400

WATER RESOURCES OF WEST-CENTRAL MISSOURI,
Geological Survey, Rollo, Mo.
E. E. Gann, E. J. Harvey, J. H. Barks, D. L. Fuller, and D. E. Miller.
Hydrologic Investigations Atlas HA-491, 1974. 4 sheets, 46 ref.

Descriptors: *Water resources, *Water quality, *Water utilization, *Hydrologic data, *Missouri, *Maps, Hydrographs, Surface waters, Groundwater, Water yield, Streamflow, Water wells, Aquifer characteristics, Planning, Land use, Urbanization, Recreation facilities, Water demand, Projections.
Identifiers: West-Central Missouri.

Future development in west-central Missouri is expected to result from continued urban expansion and from increasing recreational use of the four large reservoirs either completed or under construction. Knowledge of the water resources is necessary in planning the use and development of the area. This atlas presents a general summary of information concerning the occurrence, availability, use, and quality of water. A general definition of existing and potential problems related to the development of the water resources is also included. The atlas covers approximately 18,000 sq mi and includes all or parts of 35 counties. The area is bounded on the north by the south edge of the Missouri River flood plain, on the east by the eastern drainage divides of the Osage and Neosho River basins, and on the west and south by the Missouri State line. Water resources of the Missouri River valley are described in the published atlases shown on the index map. (Woodard-USGS)
W76-03401

HYDROLOGIC DATA FOR URBAN STUDIES IN THE SAN ANTONIO, TEXAS METROPOLITAN AREA, 1973,
Geological Survey, Austin, Tex.
R. D. Steger.
Open-file report, May 1975. 127 p, 1 fig, 5 tab, 3 ref.

Descriptors: *Urban hydrology, *Basic data collections, *Streamflow, *Water quality, *Texas, Hydrologic data, Rainfall-runoff relationships, Storm runoff, Hydrographs, Mass curves.
Identifiers: *San Antonio area(Tex).

This report contains rainfall, runoff, and water-quality data collected during the 1973 water year for the San Antonio metropolitan area. The information will be useful in determining the effects of various stages of urbanization on flood discharge and runoff and in determining chemical constituents in surface-water runoff from floods of various magnitudes during all seasons of the year from areas with different types of utilization. Detailed rainfall-runoff computations, including hydrography and mass curves, are presented for several storm periods during the 1973 water year. Storms producing the highest discharges occurred April 15, 17; June 12, 25; July 16, 17; and September 16, 26-27, 1973. (Woodard-USGS)
W76-03406

U.S. IFYGL SHIPBOARD DATA ACQUISITION SYSTEM,
International Field Year for the Great Lakes Project Office, Rockville, Md.
For primary bibliographic entry see Field 2H.
W76-03416

MATHEMATICAL OPTIMIZATION OF WATER SUPPLY SYSTEMS STATE OF THE ART,
Michigan Univ., Ann Arbor. School of Public Health.
For primary bibliographic entry see Field 5F.
W76-03441

FLOOD PLAIN INFORMATION: PETERS CREEK, BIRCHWOOD, ALASKA.
Army Engineer District, Anchorage, Alaska.
For primary bibliographic entry see Field 4A.
W76-03454

FLOOD PLAIN INFORMATION: SOUTHEAST STREAM GROUP, STOCKTON, CALIFORNIA.
Army Engineer District, Sacramento , Calif.
For primary bibliographic entry see Field 4A.
W76-03455

FLOOD PLAIN INFORMATION: WILDCAT CREEK, MANHATTAN, KANSAS.
Army Engineer District, Kansas City, Kans.
For primary bibliographic entry see Field 4A.
W76-03456

FLOOD PLAIN INFORMATION: ROARING BROOK, AVON, CONNECTICUT.
Army Engineer District, Waltham, Mass.
For primary bibliographic entry see Field 4A.
W76-03457

FLOOD PLAIN INFORMATION: ESCONDIDO CREEK, SAN DIEGO COUNTY, CALIFORNIA.
Army Engineer District, Los Angeles, Calif.
For primary bibliographic entry see Field 4A.
W76-03458

FLOOD PLAIN INFORMATION: RILLITO RIVER AND PANTANO WASH, VICINITY OF TUCSON, ARIZONA.
Army Engineer District, Los Angeles, Calif.
For primary bibliographic entry see Field 4A.
W76-03459

FLOOD PLAIN INFORMATION: BIG CREEK, LOST CREEK, CHRISTIAN CREEK AND WHITEMAN'S CREEK, JONESBORO, ARKANSAS.
Army Engineer District, Memphis, Tenn.
For primary bibliographic entry see Field 4A.
W76-03460

SPECIAL FLOOD HAZARD INFORMATION REPORT: BEAR CREEK, DENVER METROPOLITAN AREA.
Army Engineer District, Omaha, Nebr.
For primary bibliographic entry see Field 4A.
W76-03461

FLOOD PLAIN INFORMATION: CACHE LA POUDRE RIVER, COLORADO, VOLUME II, GREELEY, WELD COUNTY.
Corps of Engineers, Omaha, Nebr.
For primary bibliographic entry see Field 4A.
W76-03462

8. ENGINEERING WORKS

8A. Structures

DESIGN OF STORM SEWER NETWORKS,
Illinois Univ. at Urbana-Champaign. Dept. of Civil Engineering.
For primary bibliographic entry see Field 4A.
W76-03006

THE PLANNING AND CONSTRUCTION OF POTABLE WATER WORKS IN RELATION TO THEIR OPERATION (EL PROYECTOR Y CONSTRUCCION DE OBRAS DE AGUA POTABLE EN RELACION CON LA OPERACION),
For primary bibliographic entry see Field 5F.
W76-03253

DISTRIBUTION SYSTEM OPERATION AND MAINTENANCE.
For primary bibliographic entry see Field 4A.
W76-03287

ENGINEERING.
For primary bibliographic entry see Field 4A.
W76-03289

CONSTRUCTION.
For primary bibliographic entry see Field 4A.
W76-03291

REPORT ON ENVIRONMENTAL STUDY INTO THOMSON DAM AND ASSOCIATED WORKS.
Melbourne and Metropolitan Board of Works (Australia).

For primary bibliographic entry see Field 6G.
W76-03448

8B. Hydraulics

EFFECT OF SEPARATION ANGLE ON VORTEX STREETS,
Durham Univ., (England). Dept. of Engineering Science.
J. E. L. Simmons.
Journal of the Engineering Mechanics Division, American Society of Civil Engineers, Vol 101, No EM5, Proceedings Paper 11653, p 649-661, October 1975. 7 fig, 1 tab, 17 ref, 2 append.

Descriptors: *Vortices, *Hydrodynamics, Fluid mechanics, Boundary layers, Drag, Hydraulics, Shear drag, Shear stress, Base flow, Flow separation.
Identifiers: *Blunt bodies, *Wakes, Separation angle, Vortex streets, Bluff body, Fluid stability, Shedding frequency, Strouhal number, Aerodynamics.

Experiments were made at a constant Reynolds number of 15,000 based on model width to find how the vortex wake of a two-dimensional bluff body was affected by changing the shear layer separation angle. It was found that while each wake could be described using a universal Strouhal number previously defined in the literature, the wakes were not similar in the sense of having a common fixed spacing ratio. It was shown that this is a logical consequence of the stability criterion that is used both to derive the universal Strouhal numbers and to make predictions of the spacing rations. (Lee-ISWS)
W76-03116

EFFECTS OF STRUCTURES ON IRREGULAR WAVES COMPARED TO REGULAR WAVES,
Laval Univ., Quebec. Dept. of Civil Engineering.
Y. Ouellet, and Y. E. Morin.
Journal of the Waterways, Harbors and Coastal Engineering Division, American Society of Civil Engineers, Vol 101, No WW3, Proceedings Paper 11494, p 231-246, August 1975. 13 fig, 1 tab, 9 ref, 2 append.

Descriptors: *Breakwaters, *Coastal engineering, *Ocean waves, *Structures, *Hydraulic models, Waves(Water), Model studies, Laboratory tests, Resonance.
Identifiers: *Spectral analysis, Transfer functions, Floating breakwater, Wave energy, Resonant frequencies, Wave action.

Two structures, a fixed barrier and an A-shaped floating breakwater, were submitted to the irregular wave trains mechanically generated by a programming device. The effect of structures on waves was compared from the simulation of four types of wave spectra. Test conditions for the structures were also made variable by changing the depth of immersion and by varying the distance between the cylinders for the floating breakwater. The described tests showed that the response of a structure does not show the same information when submitted to attack by regular and irregular waves. The use of an irregular wave train permitted detection of the presence of resonant frequencies in the system under study more easily. These resonant frequencies were shown to depend on the characteristics of the structure. (Singh-ISWS)
W76-03119

WAVES OF MAXIMUM HEIGHT ON UNIFORM CURRENTS,
Delaware Univ., Newark. Coll. of Marine Studies; and Deleware Univ., Newark. Dept. of Civil Engineering.
R. A. Dalrymple, and R. G. Dean.
Journal of the Waterways, Harbors and Coastal Engineering Division, American Society of Civil Engineers, Vol 101, No WW3, Proceedings Paper 11509, p 259-268, August 1975. 6 fig, 1 tab, 11 ref, 2 append.

Descriptors: *Waves(Water), *Boundaries(Surfaces), *Hydraulics, *Laplaces equation, *Water circulation, Free surfaces, Coastal structures, Ocean waves, Coastal engineering, Wavelengths.
Identifiers: *Wave height, *Stream function wave theory, Wave propagation.

Waves in nature, generally, propagate on currents driven by winds, tidal forces, or fravity. For design of offshore structures, it is important to know the maximum height of a wave with a given wave period on a current in water. Waves of maximum height on a uniform current are determined using the stream function wave theory, assuming a symmetric wave propatating ona inviscid and incompressible fluid over a horizontal bottom. The stream function satisfies the Laplace equation throughout the fluid domain, the usual no-flow boundary condition at the bottom, and the dynamic and kinematic free surface boundary conditions. An iterative procedure, which relates a wave propagating on a constant and uniform current to an equivalent wave propagating in still water, has been used to determine the wave of maximum height in the presence of such currents. The effect of the currents is to increase the limiting wave heights when the current flows in the direction of the waves and to increase the percentage of wave crests above still water. The opposite effect is true for opposing currents. (Singh-ISWS)
W76-03120

FEEDBACK FROM FIELD STUDIES OF HYDRAULIC DREDGES,
Texas A and M Univ., College Station. Dept. of Civil Engineering.
For primary bibliographic entry see Field 8C.
W76-03122

DESIGN OF DRIP IRRIGATION MAIN LINES,
Hawaii Univ., Honolulu. Dept. of Agricultural Engineering.
I-p. Wu.
Journal of the Irrigation and Drainage Division, Proceedings of the American Society of Civil Engineers, Vol 101, No IR4, Proceedings paper No 11803, p 265-278, December 1975. 9 fig, 3 tab, 12 equ, 9 ref.

Descriptors: *Irrigation, *Irrigation design, *Irrigation systems, *Energy gradient, Optimization, Computer programs, Cost comparisons, Pipes, Design, Size, Simulation analysis, Dynamic programming, Equations, Evalation, Hazen-Williams equation, Systems analysis.
Identifiers: *Drip irrigation systems, Cost minimization, Pipe design, Papaya field.

A drip irrigation system should be designed to meet water requirements of crops, to possess the capacity to provide extra water during unusually dry period, to distribute water into fields with acceptable uniformity, and to have the lowest cost. The main lines of a drip irrigation system can be designed using a straight energy gradient line. This provides a very simple technique for selecting main line sizes that can be applied especially to evaluate alternative field layouts. An optimal shape of the energy gradient curve is determined as a curve a little bit below the straight energy gradient line. The cost difference between using the straight energy gradient line and the optimal energy gradient line is small, and only around 2%. The developed technique can be used for any kind of topographic condition, uniform or nonuniform, up and down slopes. A straight line energy gradient line can be established when a main line provide is drawn and the available water pressure is determined. The concept can be applied for different types of pipes for sprinkler system design, for water supply pipe systems, or transporting systems for other fluids. (Bell-Cornell)
W76-03160

SECOND-ORDER WAVE FORCE ON LARGE VERTICAL CYLINDER,
Chicago Bridge and Iron Company, Plainfield, Ill. Marine Research and Development.
S. K. Chakrabarti.
Journal of the Waterways, Harbors and Coastal Engineering Division, American Society of Civil Engineers, Vol 101, No WW3, p 311-317, August 1975. 1 fig, 7 ref, append.

Descriptors: *Waves(Water), *Drag, *Laplaces equation, *Ocean waves, Theoretical analysis, Equations, Coastal engineering, Estuaries, Coastal structures.
Identifiers: *Wave forces, *Nonlinear theory, Velocity potential.

The second-order force included a time-independent component as well as a double-frequency component. The nonlinearity was high even for wave height to depth ratios around 0.1. For larger wave height to depth ratios between 0.2 and 0.25, the second-order theory was found to correlate better with experimental data than did the linear wave theory. The second-order theory generally overpredicted the force. Comparison with other theories was also made. Including the kinematic free surface condition in a highly nonlinear system resulted in a significant alteration of the second-order contribution to the wave force. (Adams-ISWS)
W76-03381

WATER WAVES GENERATED BY LANDSLIDES IN RESERVOIRS,
Engineers Waterways Experiment Station, Vicksburg, Miss. Wave Branch.
For primary bibliographic entry see Field 2H.
W76-03382

LEVEE SYSTEM RELIABILITY ALONG A CONFLUENCE REACH,
Eotovs Lorand Univ., Budapest (Hungary). Dept. of Numerical Methods.
F. Szidarovszky, L. Duckstein, and I. Bogardi.
Journal of the Engineering Mechanics Division, American Soceity of Civil Engineers, Vol 101, No EM5, Proceedings Paper 11621, p 609-622, October 1975. 3 fig, 3 tab, 29 ref, 2 append. NSF GK-35791 and GF-38183.

Descriptors: *Backwater, *Flood control, Hydraulic structures, Levees, Open channel flow, Dikes, Earthworks, Hydrology, Hydraulics, Probability, Simulation analysis, Roughness coefficient, Failures, Reliability, Model studies, Risks.
Identifiers: *Uncertainty principle, *Backwater profiles.

The random stage in the main river and a flood of random stage height in the tributary determine the water level along the levee reach; a nonuniform steady flow equation is used in discretized form to compute backwater curves for each pair of values. Roughness coefficients in the bed and the flood plain are determined by a model calibration procedure. Using this information, the probability of failure in one levee cross section was computed. Another method was developed to calculate the probability of failure of the whole levee system in which a linear regression model yields discretized values of water stage in each levee subreach. Hydrologic, sample, and model uncertainties were examined. The effect of sample uncertainty was shown to increase the probability of failure of the levee. A practical example was used throughout to illustrate the methodology, which may be applied as is to other problems of this type whenever the joint probability distribution can be fitted to a normal or lognormal density function. (Lee-ISWS)
W76-03383

8C. Hydraulic Machinery

FEEDBACK FROM FIELD STUDIES OF HYDRAULIC DREDGES,
Texas A and M Univ., College Station. Dept. of Civil Engineering.
D. R. Basco.
Journal of the Waterways, Harbors and Coastal Engineering Division, American Society of Civil Engineers, Vol 101, No WW3, Proceedings Paper 11526, p 277-289, August 1975. 4 fig, 2 tab, 4 ref, 2 append.

Descriptors: *Dredging, *Harbors, *Hydraulic mining, Instrumentation, Sludge, Effluents, Hydraulic equipment, Model studies, Pipelines, On-site investigations, On-site tests, Excavation.
Identifiers: *Dredges, *Hydraulic dredging, Feedback, Hydraulic excavation, Systems engineering, Hydraulic pipelines, Total volume flow, Mass density, Density meter.

Hydraulic dredging is an extremely complicated process and much is unknown and remains to be discovered about its nature. Soil, operation, and other considerations vary considerably; therefore, actual on-the-job field dredging projects must be employed to gather information and overcome these gaps in dredging knowledge. Methods and equipment were examined for use in overcoming those obstacles that inhibit or eliminate the feedback of information from real dredging situations. It was concluded that feedback from day-to-day dredging projects is fundamental, lacking, or nonexistant, and one of the biggest problems facing the industry in 1975. These problems were not considered insurmountable. (Roberts-ISWS)
W76-03122

EXCAVATOR AND PUMPS CONQUER WATER TABLE.
Roads and Streets, Vol 118, No 10, p 96, 98, October, 1975.

Descriptors: *Sewers, *Sewerage, *Dewatering, *Construction, Pumping, Wells, Equipment, Costs, Joints(Connection), Indiana, Water table, *Pumps.
Identifiers: Trenches, Sewer excavation.

A 20,000 ft network of deep sewer trenches was dug for a $6 million interceptor sewer system in Whiting, Indiana. The route of the system, which will handle both storm water and sewerage, was within 1000 ft of the shoreline of Lake Michigan. Because the trench was dug from 20 to 30 ft deep in a layer of fine silty sand loaded with organic materials, dewatering was a difficult process. To facilitate dewatering, deep wells were installed and pumping was done two months prior to excavation. Dewatering costs were about $300,000, and the process eliminated the need for putting down sheeting or distrubing traffic in the city's business district. A 4 1/2 cu yd hydraulic excavator with a steel trench box was used for excavation after the water table had been lowered. As each pipe section was positioned, it was fitted with a round steel plate to prevent inflow of sand or water. The plate was removed and reused for each new section. Each bell joint was coated with a non-shrink plastic sealing compound. The process cost $200 per day, but the cost was more than saved in cleanup expenses when the pipe was later inspected. (Kramer-FIRL)
W76-03196

WIDE RANGE OF EQUIPMENT FOR SEWAGE DISPOSAL.
Water Services, Vol 79, No 954, p 335-336, August, 1975.

Descriptors: *Waste water treatment, *Sewerage, *Equipment, *Pumps, *Valves, Centrifugal pumps, Hydraulic equipment, Hydraulic valves, Flow control, Penstocks.
Identifiers: York(Great Britain).

Adams-Hydraulics Limited of York (Great Britain) has been manufacturing pumps and valves for sewage disposal, water pollution control, and industrial processing since 1885. The Amphistoma centrifugal sewage pump is available in a wide range of capacities up to 250 liters/sec and for maximum head limits of about 35 meters. The principal types are the vertical dry well type and horizontal patterns including portables. Compressed air actuated sewage or sludge ejector pumping units are also available. The ejector can be installed in a below ground level chamber while the compressor is placed in a nearby building since the only connection between the compressor and ejector is a small bore steel air pressure pipe. The company will supply the pumps only or will complete the total installation including all the pipework with sluice and reflux valves, all electrical equipment, erection, wiring and painting. Many designs of valves are offered by the firm including: flap valves for river and sea outlets; penstock valves for water and sewage from 80 mm up to 1800 mm diameter; a range of floating arm draw-offs; decanting valves and search arms; sludge plug valves; and relief valves. The Module valve unit is an automatic device used to limit maximum discharge especially from storm water, trade wastes, and water run-off from motorways. Appointments may be made to see the firm's wide range of products being manufactured at York. (Orr-FIRL)
W76-03213

PLASTIC PUMP HANDLES ACID USED IN WATER SYSTEM.
Water and Sewage Works, Vol 122, No 9 p 106 September, 1975.

Descriptors: *Water treatment, *Pumps, *Centrifugal pumps, *Plastics, Acids, *Electrodialysis, Membrane processes, Maintenance costs, Installation, *Treatment facilities, Florida.

The world's second largest electrodialysis water treatment system for the island of Siesta Key, west of Sarasota, Florida, is described. Its special feature is a single, all-plastic centrifugal pump, which handles the hydrochloric acid, caustic soda, and other chemicals needed in the system. The electrodialysis process involves the flushing of impure well water through stacks made up of nearly 24,000 membranes charged with either negative or positive ions. During treatment, slime or sludge builds up in the membranes, and is removed by introducing acids into the water and mixing the solution. By using the Chem-Gard heavy duty plastic horizontal centrigugal pump for mixing, both the time needed to flush the membranes and the costs of maintenance are reduced. The pump was installed at a central location, and handles over 250 gal per minute. Pipes run to the membranes, and a series of valves permits the pump to mix solutions at any of the membranes by the opening or closing of selected valves. The pump unit isolates all metal components (including the stainless steel shaft) from contact with the acid fluid being handled. The centrifugal pump has been operating for over a year, in continual on/off operation and has had no failures or parts replacement. Because the pump is mounted in a stationary position on a pedestal, the flushing time has been reduced, and no water treatment stoppages due to pump failure have been reported. (Kramer-FIRL)
W76-03217

CIRCULAR TANK SCRAPER.
Effluent and Water Treatment Journal, Vol 15, No 8, p 431, August, 1975. 1 fig.

Descriptors: *Equipment, *Sludge disposal, Engineering, *Tanks, Wind velocity, Scum, Maintenance.
Identifiers: *Scanwater Equipment Limited, *Scanscraper.

Scanwater Equipment Limited now produces a new scraper for circular and secondary tanks, known as the Scanscraper. The Scanscraper unit has many adaptable features which suit it to any application. These include: scum blade supports which may be adjusted to allow for the prevailing winds; the scum box which can be sized to specifically suit the tank's diameter; the diffuser drum sized to suit tank dimensions and adjustable for height; and, fully adjustable weir plates. The scanscraper's bridge is offered in aluminum or steel, and tests revealed that it adheres more strongly to the tank wall as prevailing winds increase in intensity. The Scanscraper carries a guarantee of after sales service performed by qualified engineers. (Beale-FIRL)
W76-03222

COMPARATIVE RIST-COST-BENEFIT STUDY OF ALTERNATIVE SOURCES OF ELECTRICAL ENERGY. APPENDIX A: ENERGY EXPENDITURES ASSOCIATED WITH ELECTRIC POWER PRODUCTION BY NUCLEAR AND FOSSIL FUELED POWER PLANTS.
Division of Reactor Research and Development (USERDA), Washington, D.C.
For primary bibliographic entry see Field 6B.
W76-03281

COLORADO RIVER AQUEDUCT OPERATION AND MAINTENANCE.
For primary bibliographic entry see Field 4A.
W76-03286

ASPECTS OF WATERWORKS PUMPING PLANT DESIGN,
G. N. Sharma.
Journal of the Institution of Water Engineers and Scientists, Vol 29, No 3, p 148-154, May, 1975. 6 tab.

Descriptors: *Pumps, *Operating costs, *Capital costs, Economics, Hydraulics, Design criteria, Hydraulic equipment.
Identifiers: Rotodynamic pumps.

Design problems for Rotodynamic pumps were discussed. Hydraulic and electrical considerations vary, according to the pump type and its specific speed. Operating costs of an installation far exceed initial plant cost and the pump peak efficiency margin is not widespread. Specific cases comparing the performance and annual running costs (ARC) of typical pumps were illustrated, based on 8750 hours at 0.70 per KW. In an example, one submersible pump installed in a borehole had a capital cost of L1625, an efficiency of 65.2%, KW input of 62.4, and an ARC of L3820, while its counterpart, with a capital cost of L2000 had an efficiency of 68.5%, KW input of 59.5, and a lower ARC (L3640). Therefore, while the initial capital cost of the first model was higher by 375 pounds, it showed an annual savings of 180 pounds and would be cheaper by its third year of operation. A study comparing two horizontal spindle type surface pumps showed a less dramatic annual savings in operating costs and a longer period for initial cost recovery. However, a pump arrangement using a submersible borehole type and a surface type in series might prove to be economical. Financial gain in operating costs is also dependent on the percentage of total head that the more efficient surface pump is required to generate. (Kramer-FIRL)
W76-03324

DEVELOPMENTS IN PUMPING SYSTEM, A TWO YEARLY REVIEW, PUMPING AND THE EMPINGHAM SCHEME.
Water and Waste Treatment, Vol 18, No 8, p 18-19, August, 1975. 3 fig.

Descriptors: *Water supply, *Reservoirs, *Pumping, *Pumps, Equipment, Rivers, Treatment facilities, Water treatment, Aqueducts.

Identifiers: Pump storage, Northampton(Great Britain).

The largest man-made reservoir in Great Britain is under construction near the village of Empingham. When completed, it will hold 27,300 million gallons of water, and provide a reliable supply of 50 mgd. Because the area is one of very low residual rainfall, a pump storage project must be implemented. The sources of water supply available are the Rivers Welland and Nene, which have wide flow rate variations. In order to take advantage of high flow rates when they occur, a pumping plant with a total capacity of 193 mgd has been installed. An aqueduct 13 miles long was also constructed, which leads from the reservoir to the farthest intake. As the aqueduct crosses the valleys of the Nene and Welland Rivers, the intervening watersheds are connected by means of pumping mains and tunnels. The final tunnel section terminates in two 33 ft diameter shafts at the foot of a dam. These shafts have been designed to accomodate 12 shaft drive borehole pumpsets. A pumping station has also been built at the foot of the dam on the side adjacent to the abstraction shafts to boost raw ater at a rate of 36 mgd to a treatment works at Wing. This treatment facility, operated by the Northhampton Water Division, will be equipped with two vertical Uniglide sets (variable speed pumps) which may operated under varying head and quantity conditions, depending upon the output required. (Kramer-FIRL)
W76-03340

USE OF JET PUMPS IN MARINE WASTE DISPOSAL,
Technion - Israel Inst. of Tech., Haifa.
For primary bibliographic entry see Field 5E.
W76-03379

8F. Concrete

GUNITING RESTORES A SEWER,
Clapsaddle-Garber, Marshalltown, Iowa.
D. C. Garber.
The American City and County, Vol 90, No 10, p 102, October, 1975.

Descriptors: *Gunite, *Sewers, *Runoff, Costs, Repairing, Concrete, Cleaning, Rainfall, Flow rates, Cleaning.

When a Tama, Iowa, storm sewer was severely damaged by heavy rainfall, complete replacement was not financially possible. Instead, it was decided to repair the system and increase the flow of runoff water. The rubble masonry walls of the sewer were cleaned, concrete roof slab was anchored to the walls, voids were filled with concrete grout, and weak spots were repaired. Wall surfaces were then smoothed by spraying gunite over wire mesh. The gunite seal, a mixture of cement, sand, and water, will be effective for several years. The restoration cost $34,000, or $6,000 less than the orginial contract estimate. The project was financed by road-tax money. (Kramer-FIRL)
W76-03193

EMERGENCY REPAIR OF CRACKED HOLDING TANK,
Illinois State Univ., Normal. Coll. of Applied Science and Technology.
A. R. Jacobson.
Public Works, Vol 106, No 10, p 114, October, 1975.

Descriptors: *Waste water treatment, *Activated sludge, *Tanks, Concrete, Repairing, Construction materials, Maintenance, Pennsylvania.
Identifiers: *Mari-Crete, Holding tanks.

Emergency measures were undertaken to repair a cracked excess sludge holding tank at a resort area waste water treatment plant at Lake Wallenpaupack, Pennsylvania. The plant was of the extended aeration activated sludge type and had an excess sludge holding tank which is emptied by tank truck periodically. During a routine maintenance check, the tank was found to have cracked at a point about four feet from the top. A concrete material, Exide Mari-Crete, was applied as a repair product and successfully sealed the tank crack without requiring a primer. The material is obtained as a dry product and is mixed with water to a putty-like consistency. Mari-Crete possesses a 24-hour compressive strength of 3100 psi and a 24-hour tensile strength of about 280 psi under humid conditions, and higher under dry conditions. After application of the repair product, a protective coating of asphalt was applied and the tank was returned to operation. (Kramer-FIRL)
W76-03209

8G. Materials

CONTINUED STUDIES ON THE USE OF A MIXED CHROMATE-PHOSPHATE INHIBITOR IN DESALINATION SERVICE: PART TWO,
Dow Chemical Co., Midland, Mich.
For primary bibliographic entry see Field 3A.
W76-03143

DEVELOPMENT, FABRICATION AND TESTING OF A PPB COPPER ANALYZER,
Dow Chemical Co., Midland, Mich.
For primary bibliographic entry see Field 3A.
W76-03144

SEA WATER CORROSION TEST PROGRAM: PART THREE,
Dow Chemical Co., Midland, Mich.
For primary bibliographic entry see Field 3A.
W76-03145

SEA WATER CORROSION TEST PROGRAM: PART FOUR,
Dow Chemical Co., Midland, Mich.
For primary bibliographic entry see Field 3A.
W76-03146

OPTIMUM SIZE OF EQUIPMENT,
Construction Estimating, Inc., West Hartford, Conn.
M. Gates, and A. Scarpa.
Journal of the Construction Division, Proceedings of the American Society of Civil Engineers, Vol 101, No CO4, Proceedings paper No. 11772, p 861-867, December 1975. 3 fig, 17 equ, 1 ref.

Descriptors: *Construction, *Construction equipment, *Value engineering, *Estimating, *Economics, *Pipelines, Planning, Size, Optimization, Linear programming, Design, Costs, Equations, Sewers, Culverts, Systems analysis.
Identifiers: *Cost minimization, Buckhoes, Capacity, Trench excavation, Pipe laying.

Generally speaking, equipment of greater capacity yields lower unit costs than does equipment of lesser capacity. However, this is not true when the equipment is employed in an operation consisting of at least one activity that is independent of, and at least one other activity that is dependent on, the size or capacity of the equipment relative to combined output. In this case, there exists an optimum size or capacity of the equipment that yields the minimum total unit cost for the combined independent and dependent activities. These relationships are explored herein and the equation for finding the optimum size or capacity of the equipment is derived. An example gives the economical size of the backhoe used both to excavate the trench and lay the pipe for a storm sewer pipe culvert. (Bell-Cornell)
W76-03161

CONTINUED STUDIES ON THE USE OF A MIXED CHROMATE-PHOSPHATE INHIBITOR IN DESALINATION SERVICE, FINAL REPORT,
Dow Chemical Co., Midland, Mich.
For primary bibliographic entry see Field 3A.
W76-03190

NONMETALLICS - THEIR PERFORMANCE IN THE DESALINATION ENVIRONMENT,
Dow Chemical Co., Midland, Mich.
For primary bibliographic entry see Field 3A.
W76-03191

RELATIONSHIPS OF CORROSION RATES TO WATER CHEMISTRY IN THE FREEPORT TEST BED PLANT,
Dow Chemical Co., Midland, Mich.
For primary bibliographic entry see Field 3A.
W76-03192

8I. Fisheries Engineering

ECONOMIC ANALYSIS OF THE INLAND FISHERIES PROJECT IN EL SALVADOR,
Auburn Univ., Ala. International Center for Aquaculture.
For primary bibliographic entry see Field 06E.
W76-03264

10. SCIENTIFIC AND TECHNICAL INFORMATION

10C. Secondary Publication And Distribution

ANNOTATED BIBLIOGRAPHY OF NOAA PUBLICATIONS OF HYDROMETEOROLOGICAL INTEREST,
National Oceanic and Atmospheric Administration, Washington, D.C.
For primary bibliographic entry see Field 02B.
W76-03183

INTERNATIONAL FIELD YEAR FOR THE GREAT LAKES.
National Oceanic and Atmospheric Administration, Rockville, Md.
For primary bibliographic entry see Field 02H.
W76-03189

BIBLIOGRAPHY OF WATER POLLUTION CONTROL BENEFITS AND COSTS,
Development Planning and Research Associates, Inc., Manhattan, Kans.
For primary bibliographic entry see Field 05G.
W76-03298

WATER QUALITY,
Geological Survey, Menlo Park, Calif.
For primary bibliographic entry see Field 05B.
W76-03395

10F. Preparation Of Reviews

ADMINISTRATION: SYSTEMS ANALYSIS, (LITERATURE REVIEW),
Cornell Univ., Ithaca, N. Y. School of Civil and Environmental Engineering.
For primary bibliographic entry see Field 06A.
W76-03159

WATER QUALITY,
Geological Survey, Menlo Park, Calif.
For primary bibliographic entry see Field 05B.
W76-03395

MATHEMATICAL OPTIMIZATION OF WATER SUPPLY SYSTEMS STATE OF THE ART,
Michigan Univ., Ann Arbor. School of Public Health.
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